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Advanced Research
Projects Agency



Defense
Nuclear
Agency



Strategic Defense
Initiative
Organization

DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

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VOLUME IV DEFENSE AGENCIES ABSTRACTS OF PHASE I AWARDS 1989

VOLUME IV

DEFENSE AGENCY PROJECTS
ABSTRACTS OF PHASE I AWARDS
FROM
FY 1989 SBIR SOLICITATION

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INTRODUCTION

On July 22, 1982 the President signed the "Small Business Innovation Development Act of 1982" (Public Law 97-219). This law became effective October 1, 1982 and was designed to give small high technology firms a greater share of Federal R&D contract awards.

The SBIR Program consists of three distinct phases. Under Phase I, DoD Components make awards to small businesses, typically of one-half to one man-year effort over a period generally not to exceed six months, subject to negotiation. Phase I is to determine, insofar as possible, the scientific or technical merit and feasibility of ideas or concepts submitted in response to SBIR topics. All DoD topics address specific R&D needs to improve our defense posture. Proposals selected for contract award are those which contain an approach or idea that holds promise to provide an answer to the specific problem addressed in the topic. The successful completion of Phase I is a pre-requisite for further DoD support in Phase II.

Phase II awards will be made only to firms on the basis of results from the Phase I effort, and the scientific and technical merit of the Phase II proposal. In addition, proposals which identify a follow-on Phase III funding commitment from non-Federal sources will be given special consideration. Phase II awards will typically cover two to five man-years of effort over a period generally not to exceed 24 months, also subject to negotiation. The number of Phase II awards will depend upon the success rate of the Phase I effort and availability of funds. Phase II is the principal research or research and development effort, and will require a more comprehensive proposal which outlines the intended effort in detail.

Phase III is expected to involve private-sector investment and support for any necessary development that will bring an innovation to the marketplace. Also, under Phase III, DoD may award follow-on contracts not funded by the SBIR Program for products or processes meeting DoD mission needs.

Selection Criteria

Phase I proposals received in each topic area in the DoD solicitation brochure are evaluated on a competitive basis in the organization which generated the topic, by scientists and engineers knowledgeable in that area and in accordance with the following criteria:

1. The scientific/technical quality of the research proposal and its relevance to the topic description, with special emphasis on its innovation and originality.

2. Qualifications of the principal investigator, other key staff, and consultants, if any, and the adequacy of available or obtainable instrumentation and facilities.

April 1990

PREFACE

On September 11, 1990, the Department of Defense (DoD) announced the selection of small business firms proposals under Phase I of the Fiscal Year (FY) 1989 DoD Small Business Innovation Research (SBIR) Program to be funded upon successful completion of contract negotiations.

The selection of proposals for funding was made from proposals received by the Military Departments, the Defense Advanced Research Projects Agency (DARPA), the Defense Nuclear Agency (DNA), and the Strategic Defense Initiative Organization (SDIO) in response to the FY 1989 solicitation distributed on October 1, 1988 with a closing date of January 6, 1989.

FY 1989 Program

	<u>Number of Topics</u>	<u>Proposals Received</u>	<u>Phase I Awards</u>
Army	86	998	92
Navy	213	2139	323
Air Force	257	3479	337
DARPA	47	596	100
DNA	14	213	14
SDIO	<u>15</u>	<u>860</u>	<u>155</u>
	632	8385	1021

In order to make information available on the technical content of the Phase I projects supported by the DoD SBIR Program, this report presents, in four volumes, the abstracts of those proposals which have resulted in contract awards.

This is Volume IV which contains abstracts and contacts for the 269 Phase I projects funded by the three participating Defense Agencies (100 DARPA projects, 14 DNA projects and 155 SDIO projects). Projects funded by the Military Services are published in separate volumes as follows:

- Volume I - Army Projects (Pages 1 - 58)
- Volume II - Navy Projects (Pages 59 - 266)
- Volume III - Air Force Projects (Pages 267 - 484)

Venture capital and large industrial firms that may have an interest in the research described in the abstracts in this publication are encouraged to contact the SBIR firm whose name and address is shown.

3. Anticipated benefits of the research to the total DoD research and development effort.

4. Adequacy of the Phase I proposed effort to show progress toward demonstrating the feasibility of the concept.

The Act mandates that all Federal Agencies establish an SBIR program if their FY 1982 extramural budgets for R&D exceeded a threshold figure of \$100 million. Beginning in FY 1983, DoD must make available the following percentages of its extramural R&D budget for this program:

Public Law 99-443, the "Small Business Innovation Act of 1986" was signed by the President on October 6, 1986. This law re-authorized P.L. 97-219 to extend the "Sunset Clause" to 1993; to continue 1.25 percent taxation of the extramural research and development budget; and excludes from taxation those amounts of the DoD research and development budget obligated solely for operational systems development.

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ADVANCED DECISION SYSTEMS

1500 PLYMOUTH ST
MOUNTAIN VIEW, CA 94043

CONTRACT NUMBER:

KEVIN J WILLEY

TITLE:

DEVELOPMENT OF IMAGE UNDERSTANDING ENVIRONMENTS

TOPIC# 39 OFFICE: PM/SBIR IDENT#: 33874

THE MAIN OBJECTIVE OF OUR WORK IS TO PRODUCE A PORTABLE, EXTENDABLE, AND MACHINE INDEPENDENT IMAGE UNDERSTANDING ENVIRONMENT. THESE ARE ESSENTIAL QUALITIES TO TAKE ADVANTAGE OF ONGOING DEVELOPMENTS IN HARDWARE AND SOFTWARE. TO ACHIEVE THIS, WE WILL TRANSFER AN ADVANCED AND POWERFUL IMAGE UNDERSTANDING ENVIRONMENT FROM THE SYMBOLICS LISP MACHINE TO MAC IIs AND NeXT MACHINES. WE WILL UTILIZE THE GENERIC SOFTWARE INTERFACES, CO-PROCESSOR EXTENDABILITY, AND DIVERSE SOFTWARE BASE ASSOCIATED WITH BOTH OF THESE TARGET MACHINES. THE ENVIRONMENT ITSELF IS WELL SUITED TO THIS TRANSFER DUE TO IT'S MODULAR DESIGN, SMALL NUMBER OF COMPONENTS, AND USE OF OBJECT-ORIENTED PROGRAMMING METHODOLOGY. THIS ENVIRONMENT WILL SUPPORT THE WORK AND COMMUNICATION OF TWO RELATED DARPA SPONSORED COMMUNITIES: IMAGE UNDERSTANDING (IU) RESEARCHERS AND THE DEVELOPERS OF IMAGE UNDERSTANDING APPLICATIONS FOR MILITARY, INDUSTRIAL, AND COMMERCIAL USES. IT PROVIDE A POWERFUL, COMMON BASIS FOR TECHNOLOGY TRANSFER AND INTEGRATION ACROSS THESE TWO COMMUNITIES.

ADVANCED DECISION SYSTEMS

1500 PLYMOUTH ST
MOUNTAIN VIEW, CA 94043

CONTRACT NUMBER:

TOM MILTONBERGER

TITLE:

RELOCATABLE TARGET DETECTION AND TARGETING TECHNOLOGY

TOPIC# 17 OFFICE: PM/SBIR IDENT#: 33875

AN INTEGRATED APPROACH FOR PERFORMING FUSION USING MULTIPLE SENSORS, NATIONAL ASSETS, AND DOCTRINAL INFORMATION IS PROPOSED. THE TARGET APPLICATION OF THE PROPOSED APPROACH IS THE STRATEGIC RELOCATABLE

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TARGET PROBLEM. A SOLUTION TO THIS PROBLEM REQUIRES CAPABILITIES BEYOND CURRENT CAPABILITIES. A NOVEL MULTI-STAGE MODEL-BASED APPROACH IS PROPOSED. INDIVIDUAL TECHNOLOGY ELEMENTS THAT ARE IN NEED OF FURTHER DEVELOPMENT ARE IDENTIFIED. A SPECIAL EMPHASIS IS PLACED ON FUSION TECHNIQUES FOR PASSIVE IR AND ACTIVE 3D LASER DATA.

ADVANCED PROJECTS RESEARCH INC

147 WARD ST

HIGHTSTOWN, NJ 08520

CONTRACT NUMBER:

THOMAS H SOBOTA

TITLE:

REDUCTION OF PLUME SIGNATURE FROM RECTANGULAR NOZZLES BY NOZZLE DESIGN FOR VORTICITY MANIPULATION

TOPIC# 22 OFFICE: PB/SBIR IDENT#: 33800

THE USE OF RECTANGULAR EXHAUST NOZZLES FOR AIRCRAFT CONFIGURATIONS OFFERS SOME INTERESTING POSSIBILITIES IN THE AREA OF FLOW MANIPULATION IN ORDER TO ENHANCE THE MIXING OF THE HOT EXHAUST PLUME WITH THE SURROUNDING COOL AIR. THIS PROPOSAL SUGGESTS THAT THE MANIPULATION AND PLACEMENT OF STREAMWISE VORTICITY IN THE FLOWFIELD WILL SERVE TO SIGNIFICANTLY INCREASE THE MIXING OF THE EXHAUST PLUMES. THE PLACEMENT OF VORTICITY HAS BEEN DEMONSTRATED AND MAY BE ACCOMPLISHED THROUGH SEVERAL MEANS. STREAMWISE VORTICITY RESULTING FROM RESIDUAL SWIRL CREATED BY THE ENGINE TURBOMACHINERY, THROUGH THE USE OF NOZZLE WALL CONTOURING, MAY BE PLACED IN SUCH A WAY AS TO CREATE WELL DEFINED STREAMWISE VORTICES. MODIFICATION OF THE FINAL TURBINE STATOR BLADE ROW MAY BE USED TO PLACE STREAMWISE VORTICITY IN THE EXHAUST PLUME. FINALLY, FORCING THE SEPARATION OF THE BOUNDARY LAYER WHICH FORMS ON THE NOZZLE WALL MAY BE USED TO MANIPULATE EXISTING VORTICITY IN THE FLOW TO CREATE AXIAL VORTICES. THE GOAL OF THE WORK PROPOSED, UNDER PHASE I, IS TO DETERMINE WHICH PATTERNS OF STREAMWISE VORTICITY WILL BEST SERVE TO ENHANCE THE PLUME MIXING AND TO PROPOSE NOZZLE GEOMETRIES WHICH WILL CREATE THESE VORTEX PATTERNS.

ADVANCED RSCH & APPLICATIONS CORP/ARACOR

425 LAKESIDE DR

SUNNYVALE, CA 94086

CONTRACT NUMBER:

DR L J PALKUTI

TITLE:

GaAs WAFER TESTING FOR RADIATION-INDUCED TRANSIENT UPSET

TOPIC# 28 OFFICE: PM/SBIR IDENT#: 33789

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THE DEVELOPMENT OF A WAFER-LEVEL TESTING TECHNIQUE FOR MULTI-GIGAHERTZ GaAs DIGITAL INTEGRATED CIRCUITS TO CHARACTERIZE THE TRANSIENT-RADIATION-INDUCED UPSET LEVEL IS PROPOSED. THIS CONCEPT WILL ALLOW THE OPTIMIZATION OF THE UPSET LEVEL IN HIGH PIN-OUT DENSITY CIRCUITS USING AN ON-SITE, QUICK TURNAROUND PROCEDURE FOR TECHNOLOGY DEVELOPMENT AS WELL AS CIRCUIT SCREENING. THIS NON-DESTRUCTIVE TECHNIQUE CAN BE APPLIED TO ESTABLISH THE ULTIMATE UPSET LEVEL WITHOUT EXPENSIVE OFF-SITE QUALIFICATION TESTING. THE PHASE I FEASIBILITY STUDY WILL INCLUDE THE IMPLEMENTATION OF SUITABLE SUBBANDGAP LASER SOURCE FOR WAFER-LEVEL SIMULATION, THE DEVELOPMENT OF A SUITABLE DATA BASE TO ESTABLISH CORRELATION BETWEEN LASER AND CONVENTIONAL LINAC SIMULATION FOR VARIOUS TEST DEVICES AND CIRCUITS; AND DEMONSTRATION OF THE APPLICABILITY OF THE LASER SIMULATION TECHNIQUE TO STATE-OF-THE-ART GaAs CIRCUITS BY EXTENDING THE EXPERIMENTAL DATA BASE WITH PHOTORESPONSE SIMULATION.

ADVANCED SCIENTIFIC CONCEPTS INC
2441 FOOTHILL LN
SANTA BARBARA, CA 93105
CONTRACT NUMBER:
DR ROGER STETTNER
TITLE:
A HIGH RESOLUTION POSITION SENSITIVE DETECTOR
TOPIC# 5 OFFICE: PM/SBIR IDENT#: 33851

THERE IS A CURRENT NEED TO REMOTELY AND NONDESTRUCTIVELY IDENTIFY NUCLEAR SOURCES WITHIN STRUCTURES (OBJECTS) THAT ARE OPAQUE TO ALL BUT NUCLEAR RADIATION. SITUATIONAL EXAMPLES ARE THE IDENTIFICATION OF NUCLEAR SPACE MINES IN THE VICINITY OF BALLISTIC MISSILE DEFENSE SATELLITES AND NUCLEAR WEAPONS TREATY VERIFICATION. IF THE SPATIAL DISTRIBUTION OF NUCLEAR MATERIAL WITHIN THE STRUCTURE CAN BE IMAGED THEN, TOGETHER WITH GAMMA-RAY SPECTRAL INFORMATION, THE FUNCTION OF THE NUCLEAR MATERIAL CAN BE DERIVED. NUCLEAR WEAPONS HAVE VERY DEFINITE NUCLEAR MATERIAL CONFIGURATIONS. SPATIAL RESOLUTION IS A PIVOTAL IMAGING SENSOR ISSUE. NUCLEAR MATERIAL FUNCTION IDENTIFICATION REQUIRES A RESOLUTION OF ROUGHLY 2 CM WHICH IS BEYOND THE CAPABILITY OF CURRENT SENSORS, FOR ANY PRACTICAL OBJECT-SENSOR DISTANCE. THE SENSOR PROPOSED HEREIN SOLVES THE HIGH RESOLUTION

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PROBLEM. THIS IS A PROPOSAL FOR A NOVEL, HIGH SPATIAL RESOLUTION, GAMMA-RAY SENSOR FOR IDENTIFICATION OF NUCLEAR MATERIAL CONFIGURATIONS. THE SENSOR IS CALLED THE HIGH RESOLUTION GAMMA-RAY CAMERA (HRCAM). THE FOCUS OF THE PROPOSAL IS ON THE HIGH RESOLUTION POSITION SENSITIVE GAMMA-RAY DETECTOR INTERNAL TO THE HRCAM.

ADVANCED TECHNOLOGY MATERIALS INC

520-B DANBURY RD

NEW MILFORD, CT 06776

CONTRACT NUMBER:

DR DUNCAN W BROWN

TITLE:

PRECURSORS FOR CARBON FREE AlGaAs

TOPIC# 35

OFFICE: PM/SBIR

IDENT#: 33790

WIDESPREAD APPLICATION OF HIGH PERFORMANCE DEVICES BASED ON III-VI COMPOUND SEMICONDUCTOR WILL DEPEND ON THE DEVELOPMENT OF ECONOMIC AND HIGH-QUALITY MANUFACTURING METHODS. DURING THE LAST FEW YEARS, ORGANOMETALLIC BASED PROCESSES HAVE EVOLVED INTO THE MOST PROMISING TECHNIQUES FOR THE PRODUCTION OF ULTRA-HIGH PURITY COMPOUND SEMICONDUCTOR MATERIALS IN COMPLEX LAYERED STRUCTURES REQUIRED FOR ADVANCED DEVICES. FEASIBILITY HAS BEEN DEMONSTRATED IN THE LABORATORY; EPITAXIAL LAYERS WITH THE REQUIRED INTERFACE ABRUPTNESS AND CLOSE TO THE REQUIRED PURITY HAVE BEEN OBTAINED FOR THE MATERIALS SYSTEMS OF MAJOR INTEREST, GaAs/AlGaAs AND GaInAsP/InP. A MAJOR CHALLENGE NOW CONFRONTS BOTH THE MATERIALS AND CHEMICAL COMMUNITIES. SIGNIFICANT PROGRESS MUST BE MADE IN ALUMINUM PRECURSOR IDENTITY, QUALITY, AND CONSISTENCY. ALUMINUM-CONTAINING FILMS, EVEN P-TYPE LAYERS GROWN WITH ADDUCT PURIFIED TRIMETHYLALUMINUM, STILL CONTAIN UNACCEPTABLY HIGH QUANTITIES OF CARBON. IN PHASE I WE WILL DEMONSTRATE REDUCED CARBON INCORPORATION IN AlGaAs THROUGH THE INTRODUCTION OF A NEW ALUMINUM SOURCE REAGENT. IN PHASE II WE WILL DEVELOP MANUFACTURING METHODS FOR THE PRODUCTION OF ELECTRONIC GRADE MATERIAL.

ADVANCED TECHNOLOGY MATERIALS INC

520-B DANBURY RD

NEW MILFORD, CT 06776

CONTRACT NUMBER:

DR WARD C STEVENS

TITLE:

HIGH T_c SUPERCONDUCTING TAPES

TOPIC# 32

OFFICE: PM/SBIR

IDENT#: 33871

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THE DEVELOPMENT OF A MANUFACTURING TECHNOLOGY THAT ALLOWS FOR THE OPTIMIZATION OF THE MECHANICAL AND SUPERCONDUCTING PROPERTIES OF HIGH TEMPERATURE SUPERCONDUCTORS IS CRUCIAL FOR THEIR IMPLEMENTATION IN ENERGY STORAGE DEVICES, MOTOR, GENERATORS, AND ELECTROMAGNETIC LAUNCHERS. STATE-OF-THE-ART PROCESSING NOW YIELDS HIGH TEMPERATURE SUPERCONDUCTING MATERIALS WITH ENCOURAGING ELECTRICAL PROPERTIES, BUT WHOSE MECHANICAL PROPERTIES ARE CONSTRAINED BY THE BRITTLINESS OF THE CERAMIC OXIDE. THIS PROBLEM IS RETARDING THE USE OF THESE MATERIALS IN A WIDE VARIETY OF APPLICATIONS. THE PROPOSED SOLUTION TO THIS PROBLEM IS THE CONSOLIDATION OF EXISTING SMALL DIAMETER SUPERCONDUCTING FILAMENTS INTO A TAPE WHOSE MECHANICAL PROPERTIES AND ENVIRONMENTAL STABILITY ARE FAR SUPERIOR TO THE FILAMENT ALONE. A PROCESS TO PREPARE THESE TAPES UTILIZING NOVEL MOCVD TECHNOLOGY AND PLASMA DEPOSITION HAS BEEN IDENTIFIED. IN PHASE I, UNIAXIALLY ALIGNED STATE-OF-THE-ART SUPERCONDUCTING FILAMENTS WILL BE HERMETICALLY SEALED AND THEN ENCAPSULATED WITH METAL TO FORM METAL MATRIX COMPOSITE TAPES. THESE TAPES WILL BE TESTED TO DETERMINE THEIR MECHANICAL AND ELECTRICAL PROPERTIES. IN PHASE II CONTINUOUS PROCESSING WILL BE DEVELOPED AND THE RESULTING TAPES USED TO FABRICATE A MULTI-FILAMENT CONDUCTOR WHICH WILL BE EMPLOYED IN AN OPERATING PROTOTYPE DEVICE AND TESTED.

AEROCON INC
1901 N MOORE ST - STE 1204
ARLINGTON, VA 22209
CONTRACT NUMBER:
STEPHAN F HOOKER
TITLE:
HIGH SPEED MERCHANT SHIP CONCEPTS
TOPIC# 43 OFFICE: PM/SBIR IDENT#: 39430

THIS PROPOSAL OUTLINES AN APPROACH TO BRING TO THE U.S. GOVERNMENT AND INDUSTRY A TECHNOLOGY AND CONCEPT FOR THE DEVELOPMENT VESSELS CAPABLE OF TRANSITING THE OCEANS AT OR ABOVE 300-400 KNOTS AND INITIALLY DISPLACING 1000 TO 5000 TONS. WHILE THE SPEEDS WILL REMAIN SUBSONIC, THESE VESSELS ARE NOT PHYSICALLY BOUND, AND COULD GROW TO APPROXIMATE SHIP DIMENSIONS AND DISPLACEMENTS, DEPENDING ON MISSION. THE WINGSHIP (SOVIET EKRAKNOPLAN/WIG) OPERATIONALLY AND

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ECONOMICALLY SITS ASTRIDE THE PRESENT DAY SHIP AND SUBSONIC AIRPLANE. THE MILITARY BENEFIT IS ESPECIALLY ENHANCED BY THE CRAFT'S NATURAL LOW DRAFT (10 FEET OR LESS) AND LOW OBSERVABLE FEATURES; THE WINGSHIP PROVIDES A MEANS TO CARRY SIGNIFICANT PAYLOADS WITHOUT AT THE SAME TIME BECOMING A HIGH PRIORITY PRIMARY TARGET. COMMERCIALY, IN CONTRAST TO THE HYPERSONIC TRANSPORT, THE WINGSHIP OFFERS LOW FARE MASS TRANSIT TO ANYWHERE IN THE WORLD.

AMERINEX ARTIFICIAL INTELLIGENCE INC
274 N PLEASANT ST
AMHERST, MA 01002
CONTRACT NUMBER:
DR THOMAS D WILLIAMS
TITLE:
DEVELOPMENT AND DISTRIBUTION OF SHARABLE ADVANCED IMAGE
UNDERSTANDING ALGORITHMS
TOPIC# 39 OFFICE: PM/SBIR IDENT#: 33801

THIS PROJECT WILL DEMONSTRATE THE EFFECTIVENESS OF A NEW APPROACH TO THE TRANSFER OF TECHNOLOGY IN IMAGE UNDERSTANDING (IU). IT IS BASED UPON THE USE OF A SHARED SOFTWARE DEVELOPMENT ENVIRONMENT FOR IU, CALLED THE KBVISION (tm) SYSTEM, WHICH CAN SERVE TO EASE THE TRANSFER OF COMPUTER VISION ALGORITHMS. THE PHASE I PROPOSAL WILL DEMONSTRATE THE FEASIBILITY OF THE TRANSFER OF IU SOFTWARE BY SHARING SOME ALGORITHMS BETWEEN A FEW INSTITUTIONS. EACH ALGORITHM WILL BE RE-CODED, CAREFULLY DOCUMENTED, PROVIDED WITH A CLEAN GRAPHIC USER INTERFACE TO A SET OF KEY PARAMETERS FOR CONTROLLING THE ALGORITHM, AND THEN DISTRIBUTED TO A SET OF PARTICIPATING INSTITUTIONS. THIS INITIAL EFFORT WILL INVOLVE PORTING SOFTWARE DEVELOPED AT CARNEGIE-MELLON UNIVERSITY WITH THE COOPERATION OF PROFESSOR TAKEO TANADE. THE PHASE II EFFORT WILL INITIATE A BROADER EFFORT ACROSS THE DARPA IU COMMUNITY.

ANRO ENGINEERING CONSULTANTS INC (ANRO)
1800 - 2ND ST/STE 965
SARASOTA, FL 34236
CONTRACT NUMBER:
DR GERALD F ROSS
TITLE:
RADAR ANTENNA CROSS-SECTION REDUCTION TECHNIQUES
TOPIC# 23 OFFICE: PM/SBIR IDENT#: 33887

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APA OPTICS INC
2950 NE 84TH LN
BLAINE, MN 55434
CONTRACT NUMBER:
DR M ASIF KHAN

TITLE:

LOW THRESHOLD MULTIPLE QUANTUM WELL LASER FOR HIGH DENSITY
ELECTRONIC PACKING APPLICATIONS

TOPIC# 26 OFFICE: PM/SBIR IDENT#: 33879

OPTICAL INTERCONNECT TECHNOLOGY PROMISES TO PROVIDE SIGNIFICANT RELIEF FROM THE PINOUT PROBLEM, DECREASE IMPLEMENTATION COMPLEXITY, AND PROVIDE IMPROVEMENTS TO THE FLEXIBILITY AND REAL-TIME RECONFIGURATION FOR HIGH DENSITY ELECTRONIC PACKING APPLICATIONS SUCH AS VLSI/VHSIC. OPTICAL INTERCONNECT REQUIREMENTS, IN GENERAL, CAN BE DIVIDED INTO FOUR AREAS: DEVICES, ROUTING MECHANISMS, PACKING TECHNIQUES, AND ARCHITECTURE DEVELOPMENTS. IN PARTICULAR, DEVICES WHICH CAN TRANSFORM ELECTRICAL SIGNALS TO TOPICAL SIGNALS AND VICE VERSA (SEMICONDUCTOR DIODE LASERS, LIGHT EMITTING DIODES, DETECTORS) ARE REQUIRED TO IMPLEMENT OPTICAL INTERCONNECTS. LOW THRESHOLD HIGH SPEED LASERS BEYOND THE CURRENT STATE-OF-THE-ART ARE REQUIRED TO ADDRESS SPEED, AND LARGE FANOUT PROBLEMS. IN PHASE I OF THE PROPOSED EFFORT WE PROPOSE THE DEVELOPMENT OF A HIGH SPEED DIRECT CURRENT MODULATION MQW LASER BASED UPON OUR UNIQUE APPROACH OF REDUCING THE DEVICE CAPACITANCE BY USING SEMI-INSULATING SUBSTRATES AND ETCHING THE BOTTOM N + CONDUCTION LAYER FROM UNDER THE TOP CONTACT PAD. TO THE BEST OF OUR KNOWLEDGE, SUCH AN APPROACH HAS NEVER BEEN TRIED BEFORE. WE FEEL THIS DECREASE OF CAPACITANCE WILL RESULT IN AN INCREASE OF THE MAXIMUM RELAXATION OSCILLATION FREQUENCY. THE FIRST PHASE WILL CONSIST OF PERFORMING REQUIREMENTS AND DESIGN ANALYSIS, FABRICATING LASERS OF SI AND N + SUBSTRATES AND COMPARING THEIR RELAXATION OSCILLATION FREQUENCIES TO PROVE THE VALIDITY OF OUR TECHNICAL APPROACH. THE SECOND PHASE WILL BE AIMED AT DEVICE OPTIMIZATION, PACKAGING ISSUES, BUILDING AND TESTING A DEMO MODEL FOR DEMONSTRATING THE HIGH DENSITY ELECTRONIC PACKING APPLICATION.

APPLIED RESEARCH ASSOCS INC
4300 SAN MATEO BLVD NE - STE A220
ALBUQUERQUE, NM 87110

CONTRACT NUMBER:

JAMES H BOSCHMA

TITLE:

BETATRON SOFT KILL DEVICE

TOPIC# 27 OFFICE: PM/SBIR IDENT#: 33873

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A FEASIBILITY STUDY IS PROPOSED ON A NOVEL CONCEPT FOR DESIGN OF AN ELECTRONIC KILL (SOFT KILL) DEVICE. THE CONCEPT UTILIZES CONVENTIONAL MEANS TO DELIVER A HIGH ENERGY RADIATION PRODUCING DEVICE (A "BETATRON") IN CLOSE PROXIMITY TO THREAT WEAPON SYSTEMS, THEREBY DESTROYING ELECTRONIC COMPONENTS INTEGRATED INTO, OR IN SUPPORT OF, THREAT WEAPON SYSTEMS. AS THE BETATRON COLLAPSES UNDER PRESSURE FROM HIGH EXPLOSIVES CONTAINED IN THE DELIVERY SYSTEM, IT FORWARD SCATTERS HIGH ENERGY GAMMA RADIATION IN A CONE-LIKE GEOMETRY, PRODUCING A HIGH PROBABILITY OF PERMANENT DAMAGE TO ELECTRONIC DEVICES WITHIN THE CONE OF RADIATION. PREVIOUS RESEARCH CONDUCTED BY SANDIA NATIONAL LABORATORY UNDER THE CODE NAME "DELPHI", FOR THE OFFICE OF STRATEGIC DEFENSE; AND BETATRON RESEARCH CONDUCTED BY BOTH U.S. AND SOVIET SOURCES SUPPORTS THE POSSIBILITY OF THIS DEVICE.

ATLANTIC AEROSPACE ELECTRONICS CORP
6404 IVY LN - STE 300
GREENBELT, MD 20770
CONTRACT NUMBER:
ERIC R KEYDEL

TITLE:

CLUTTER REDUCTION AND RESOLUTION ENHANCEMENT TECHNIQUES FOR FOLIA
PENETRATING SYNTHETIC APERTURE RADAR SYSTEMS

TOPIC# 17 OFFICE: PM/SBIR IDENT#: 33849

THIS RESEARCH PROPOSAL IS AIMED AT PRELIMINARY INVESTIGATION AND FEASIBILITY ASSESSMENT OF SIGNAL PROCESSING TECHNIQUES FOR IMPROVING THE SIGNAL-TO-CLUTTER RATIO IN FOLIAGE PENETRATION SYNTHETIC APERTURE RADAR (SAR) DATA, BASED ON ADAPTIVE CROSS-MODELING OF THE COMPETING CLUTTER THROUGH THE USE OF MULTIPLE RADAR FREQUENCIES. THE ADAPTIVE CROSS-MODELING APPROACH SEEKS TO ESTIMATE THE CLUTTER RETURNS IN LOW FREQUENCY, LOW RESOLUTION FOLIAGE PENETRATING SAR DATA, BY USING HIGHER RESOLUTION SAR IMAGERY OF THE SAME GROUND AREA COLLECTED AT A HIGHER, NON-FOLIAGE-PENETRATING, RADAR FREQUENCY. OUR INITIAL PROPOSED TECHNIQUE OPERATES ON COMPLEX IMAGERY (AMPLITUDE AND PHASE), AND MODELS THE CLUTTER RETURNS IN EACH (LARGE) RESOLUTION CELL OF THE LOW FREQUENCY IMAGE AS A SCALED AND BLURRED VERSION OF THE MEASURED CLUTTER DATA IN A CONTIGUOUS GROUPING OF (SMALLER) RESOLUTION CELLS OF THE HIGH FREQUENCY DATA, COVERING THE SAME

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GROUND PATCH. SCALING OF THE CLUTTER RETURNS FROM ONE FREQUENCY TO THE OTHER IS DEPENDENT ON CLUTTER TYPE, WHICH IN TURN IS ASSESSED USING IMAGE PROCESSING ALGORITHMS OF THE TYPE DEVELOPED FOR TERRAIN CLASSIFICATION, AND MODIFIED FOR APPLICATION TO SAR DATA. THE PHASE I PROPOSAL INCLUDES DEVELOPMENT OF A MULTI-FREQUENCY SAR SIMULATION CAPABILITY TO SUPPORT PRELIMINARY ALGORITHM DEVELOPMENT, PLUS IMPLEMENTATION AND PRELIMINARY FEASIBILITY ASSESSMENT OF THE BASIC CROSS-MODELING APPROACH. REFINEMENT OF THE CLUTTER SUPPRESSION ALGORITHMS AND THE DEVELOPMENT AND EVALUATION OF TARGET DETECTION AND IDENTIFICATION TECHNIQUES APPROPRIATE TO THE CLUTTER-REDUCED DATA ARE PROJECTED FOR PHASE II, PENDING SUCCESSFUL COMPLETION OF THE PHASE I TECHNICAL OBJECTIVES.

AUTOMETRIC INC
5301 SHAWNEE RD
ALEXANDRIA, VA 22312
CONTRACT NUMBER:
CARROLL LUCAS
TITLE:

FUSION OF INFORMATION FROM SYNTHETIC APERTURE RADAR (SAR) THERMAL IMAGERY MULTISPECTRAL AND TOPOGRAPHIC DATA TO DETECT GROUND...
TOPIC# 3 OFFICE: PM/SBIR IDENT#: 33815

THE PROPOSED EFFORT WILL INVESTIGATE THE UTILITY OF MULTISENSOR IMAGERY PRODUCTS TO SATISFY REQUIREMENTS FOR DETECTION AND MONITORING OF UNDERGROUND EXPLOSIONS, SUCH AS THOSE PRODUCED AT NUCLEAR TEST SITES. THE RESEARCH WILL INVOLVE AN ANALYSIS OF EXISTING RADAR, THERMAL, MULTISPECTRAL, AND TOPOGRAPHIC PRODUCTS OBTAINED OVER A U.S. TEST SITE. HARDCOPY AND SOFTCOPY ANALYSES WILL YIELD INFORMATION ABOUT SOIL DISTURBANCES, GROUND FEATURE CHANGES, AND OTHER RELEVANT INDICATORS OF EXPLOSIVE ACTIVITY. FINDINGS AND MEASUREMENTS FROM EACH IMAGE WILL BE COMBINED IN A GEOGRAPHIC INFORMATION DATA BASE. VARIOUS IMAGE AND MAP PROJECTS WILL BE REGISTERED TO ONE ANOTHER TO DETERMINE WHETHER SUCH FUSION PROVIDES ADDITIONAL INFORMATION.

AV DYNAMICS INC
825 MYRTLE AVE
MONROVIA, CA 91016
CONTRACT NUMBER:
DR P B S LISSAMAN
TITLE:

DESIGN CRITERIA FOR PARTIAL SPANLOADER AIRPLANE
TOPIC# 20 OFFICE: PM/SBIR IDENT#: 33864

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THERE IS NO ACCEPTED PRELIMINARY DESIGN METHOD FOR HIGH ALTITUDE, LONG ENDURANCE (HALE) VEHICLES. IMPORTANT TO NASA, SDIO AND ALL BRANCHES OF DOD, THEY ALL HAVE VERY LONG SPANS, VERY LIGHT WING LOADING, AND VERY LARGE FUEL/PROPULSION FRACTIONS. MOST CONFIGURATIONS ARE PARTIAL SPAN-LOADERS, THUS ATMOSPHERIC TURBULENCE IS THE CRITICAL DESIGN LOADING. WITH NO SIMPLE ENGINEERING METHOD TO ESTIMATE BENDING MOMENT ON A TURBULENCE-LOADED WING OF THIS TYPE, PRELIMINARY DESIGN PROCEDURES ARE VERY ARBITRARY. THE PROPOSED WORK WILL PROVIDE A DESIGN CRITERION FOR PARTIAL SPAN-LOADERS, WITH CENTRAL AND OUTBOARD POINT LOADS AND OF QUITE GENERAL CONFIGURATION IN GENERAL ATMOSPHERIC TURBULENCE EXCITATION, BY SOLVING THE AERO-ELASTIC EQUATIONS AND DETERMINING THE FLUCTUATING MOMENTS. COMBINING THIS WITH THE MISSION SCENARIO, THE FAILURE PROBABILITY CAN BE CALCULATED. DESIGN CRITERIA FROM WHICH MOMENTS AND FAILURE PROBABILITIES CAN BE DETERMINED WILL BE DEVELOPED IN GRAPHICAL FORM OR AS SIMPLE COMPUTER CODES. THESE WILL BE OF VALUE TO ALL GROUPS CONCERNED WITH HALE TECHNOLOGY, INCLUDING DOD PROCURMENT AGENCIES, AEROSPACE MANUFACTURERS AND GROUPS PERFORMING SYSTEM EVALUATION AND TECHNICAL ASSESSMENT. THE WORK LEADS TO A SECOND PHASE FOR MORE COMPLEX CONFIGURATIONS IN WHICH MORE COMPREHENSIVE GUIDELINES WILL BE DEVELOPED.

AVOGADRO ENERGY SYSTEMS INC
101 DANIEL LOW TER - RM 6D
STATEN ISLAND, NY 10301

CONTRACT NUMBER:

DR JAN S BRZOSKO

TITLE:

HUNTER SYSTEM FOR LAND MINES DETECTION - NUCLEAR METHOD

TOPIC# 11 OFFICE: PM/SBIR IDENT#: 33866

OUR RESEARCH PROPOSAL OF LAND MINES DETECTION BY A NUCLEAR ACTIVATION METHOD IS BASED ON A NEW EXTREMELY INTENSE, COMPACT PULSED SOURCE OF 14.1 MeV NEUTRONS (WITH A YIELD $Y(n)=5.10(12)$ NEUTRONS/50 ns PULSE AND A SOURCE REPETITION RATE 1 Hz). WE HAVE DEVELOPED AND CARRIED OUT EXPERIMENTS WITH (a) COMPACT ACCELERATOR PLASMA TARGET SYSTEMS (CAPT). THIS IS A NEW GENERATION OF DEVICES WHICH IS OBTAINED BY IMPROVING PLASMA FOCUS MACHINES OF THE MATHER TYPE. (b) POWERFUL

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3D-MONTE CARLO (FOR TREATING RANDOM WALK OF RADIATION THROUGH MATTER; ANALOGUE, CONTINUOUS IN ENERGY AND SPACE, NUMERICAL CODE WHICH IS SUITABLE FOR HANDLING ANY GEOMETRY, MATERIALS, NUCLEAR PROCESSES). FOR PHASE I WE PROPOSE TO GENERATE-NUMERICALLY-ENERGY SPECTRA OF NEUTRONS AND GAMMAS (INCLUDING THEIR TIME OF EMISSION) FROM NEUTRON-IRRADIATED MINES (WE CONSIDER BURIED MINES IN THE GROUND; THE SPECTRA WILL BE DETERMINED AT THE LOCATION OF THE DETECTOR SURFACE). THIS WILL ESTABLISH THE OPTIMUM RANGES (ENERGY, TIME) OF THE DETECTION METHOD, THE CHARACTERISTIC PARAMETERS OF THE NEUTRON SOURCE, THE REQUIRED RADIATION SHIELDS FOR PERSONNEL PROTECTION. IN PHASE II WE PROPOSE (a) TO CONVERT THE CAPT SOURCE (USED IN LABORATORY EXPERIMENTS) INTO A PROTOTYPE FOR FIELD OPERATION TESTING; (b) TO PROVIDE A PROOF-OF-PRINCIPLE FOR THE OPERATION OF THE CHOSEN DETECTION SYSTEM FROM PHASE I.

BLUESTONE PRO-FARMS INC
50241 - 8TH AVE
GRAND JUNCTION, MI 49056
CONTRACT NUMBER:

DUANE P SNYDER

TITLE:

SEALS FOR LIGHT-WEIGHT COMPACT TRUE ROTARY ENGINE

TOPIC# 20 OFFICE: PM/SBIR IDENT#: 33856

IN THE FIELD OF REMOTELY PILOTED VEHICLES (RPV'S) GREATER EMPHASIS HAS BEEN PLACED ON ACHIEVING COMBINATIONS OF HIGHER ALTITUDE, LONGER ENDURANCE, GREATER PAYLOAD CAPACITY, AND ARE MORE COST EFFECTIVE. TO THIS END A LIGHT-WEIGHT, POWERFULL, COMPACT, FUEL EFFICIENT AND INEXPENSIVE ROTARY PROPULSION ENGINE DEVELOPMENT PROGRAM IS PLANNED WHICH WOULD ADDRESS ITSELF TO ACHIEVING THE ABOVE EMPHASIZE COMBINATIONS. PHASE I WOULD BE THE PRELIMINARY DEVELOPMENT WORK ON THE SEALS THAT PROVIDE SEALING FOR THE COMBUSTION CHAMBER OF THE INNOVATIVE ROTARY ENGINE. THE TESTING AND CARDING OF COMPRESSION PRESSURES AND MEASUREMENTS OF POSITIONAL LEAK RATES ARE PLANNED. STATED OTHERWISE, PHASE I WOULD BE THE DEMONSTRATION OF THE TECHNICAL FEASIBILITY OF THE COMBUSTION CHAMBER SEALS.

BROWN R G ASSOCS INC
PO BOX 100
HILLPOINT, WI 53937
CONTRACT NUMBER:

ROBERT G BROWN

TITLE:

NEWEST GENERATION SOLID STATE INERTIAL MEASUREMENT UNIT APPLICATI
TO TANK AND HOWITZER-FIRED INERTIALLY GUIDED CONVENTIONAL MUNITION

TOPIC# 16 OFFICE: PM/SBIR IDENT#: 33836

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FEASIBILITY STUDY FOR APPLICATION OF MICROMECHANICAL GYRO AND ACCELEROMETER TECHNOLOGY OR OTHER SOLID STATE INERTIAL SENSORS FOR INERTIALLY GUIDED CONVENTIONAL MUNITIONS. INERTIAL MEASUREMENT UNITS (IMU'S) ARE CONCEPTUALLY DEFINED FOR USE ON THE MUNITION AND ON THE WEAPON DELIVERY PLATFORM. ESTIMATES OF IMPACT ACCURACY MADE. IMU REQUIREMENTS ARE DEFINED. INNOVATIVE DUAL IMU APPROACH APPLIED TO TANK OR HOWITZER. ELEMENTS OF ALGORITHM DEFINED FOR COMPUTATION OF WEAPON DELIVERY MOTION AND ALLOW RAPID FIRING. ASSESSMENT MADE OF NEWEST GENERATION SOLID STATE INERTIAL SENSOR TECHNOLOGIES.

CASCADE MICROTECH INC
14255 SW BRIGADOON CT - STE C
BEAVERTON, OR 97005
CONTRACT NUMBER:
ERIC W STRID

TITLE:

MULTI-GIGAHERTZ BANDWIDTH HIGH PINOUT DENSITY WAFER PROBE
TOPIC# 28 OFFICE: PM/SBIR IDENT#: 33824

A MEMBRANE TYPE WAFER PROBE IS PROPOSED WHICH, AT THE END OF PHASE II, WILL ACHIEVE TRANSMISSION OF SIGNALS FROM TESTER TO DIE WITH LOW ABBRATIONS FOR A 100 ps RISETIME. CAPABILITIES WILL INCLUDE LOW-IMPEDANCE GROUND AND POWER CONTACTS, WITH LSI-LEVEL NUMBERS AND DENSITIES OF SIGNAL LINES. PHASE I WORK WILL DETERMINE THE DESIGN PARAMETERS NECESSARY FOR THESE GOALS THROUGH A SEQUENCE OF CALCULATIONS, SCALE MODELLING, AND PROTOTYPE FABRICATION AND TESTING.

CBF & ASSOCS INC
PO BOX 254
BURKE, VA 22015
CONTRACT NUMBER:
ISAAK MAYERGOYZ

TITLE:

AUTONOMOUS HUNTER/KILLER COUNTERMINE SYSTEM USING THE FREQUENCY SIGNATURE APPROACH FOR THE DETECTION OF PLASTIC MINES
TOPIC# 11 OFFICE: PM/SBIR IDENT#: 33848

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YDTECTION OF ALL CLASSES OF MINES, METAL OR PLASTIC CASED, BURIED OR ON THE SURFACE CANNOT BE RELIABLY DETECTED USING CURRENT TECHNOLOGY. THE PROPOSED RESEARCH WILL EXAMINE BOTH THE CONCEPT OF FREQUENCY SIGNATURE AS THE MEANS OF DETECTION OF PLASTIC MINES, AS WELL AS SELECT COMPLIMENTARY CURRENTLY AVAILABLE TECHNOLOGIES TO INSURE RELIABLE DETECTION. IN ADDITION, THE EFFORT WILL EXAMINE A VARIETY OF KILL MECHANISM WHICH COULD BE EMPLOYED AND WHOSE USE WOULD INSURE SAFETY OF THE HUNTER/KILLER COUNTERMINE PLATFORM.

CHARLES SYSTEMS CORP

820 HEATHERWAY

ANN ARBOR, MI 48104

CONTRACT NUMBER:

HEIDI N JACOBUS

TITLE:

WHAT IS AN INTUITIVE COCKPIT DISPLAY

TOPIC# 18

OFFICE: PM/SBIR

IDENT#: 33846

ALONG WITH TREMENDOUS ADVANCES IN THE TECHNOLOGY SUPPORTING GRAPHICAL AND HEADS-UP DISPLAYS COMES A DIZZYING ARRAY OF OPTIONS FOR THE DISPLAY OF COMPLEX STATIC AND DYNAMIC INFORMATION TO PILOTS IN MODERN AIRCRAFT. TO DATE, RESEARCH ON THE EFFECTIVENESS OF GRAPHICAL DISPLAY FORMATS AS AIDS TO DECISION-MAKING AND MONITORING HAS BEEN LARGELY EQUIVOCAL (JARVENPAA AND DICKSON, 1988) (SANDERSON, FLACK, BUTTIGIEG AND CASEY, 1988). THE SOURCE OF THE PROBLEM IS ROOTED IN LACK OF BASIC THEORY IN MATCHING DISPLAY FORMATS (AND PRESENTATION METHODS) TO TASK INFORMATION REQUIREMENTS (CARSWELL AND WICKENS, 1987) (FREY, SIDES, HUNT, AND ROUSE, 1984). TO ADDRESS THIS PROBLEM WE WILL DEVELOP A THEORY-BASED APPROACH TO COCKPIT (AND OTHER) DISPLAY DESIGN, WILL DEFINE A RAPID-PROTOTYPING BASED DISPLAY CONSTRUCTION AND EVALUATION METHODOLOGY, AND WILL SUPPORT THIS METHODOLOGY WITH A KNOWLEDGE-BASED SOFTWARE ENVIRONMENT.

COGNITECH INC

426 LINCOLN BLVD

SANTA MONICA, CA 90402

CONTRACT NUMBER:

DR LEONID RUDIN

TITLE:

RECONSTRUCTION AND ENHANCEMENT OF SIGNALS USING NON-OSCILLATORY SHOCK/TURBULENCE CAPTURING ALGORITHMS

TOPIC# 36

OFFICE: PM/SBIR

IDENT#: 33855

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THE CONCEPTS AND TECHNIQUES DEVELOPED IN THE NUMERICAL SOLUTION OF HYPERBOLIC CONSERVATION LAWS E.G. IN COMPRESSIBLE GAS DYNAMICS HAVE RECENTLY BEEN FOUND BY THIS COMPANY TO BE EXTREMELY RELEVANT TO THE PROBLEM OF RECONSTRUCTION AND ENHANCEMENT OF SIGNALS (INCLUDING IMAGES AND ACOUSTIC SIGNALS). BOTH SUBJECTS DEAL WITH THE DISCRETE REPRESENTATION OF DISCONTINUOUS FUNCTIONS. THE RELEVANT CONCEPTS INCLUDE VARIATION DIMINISHING OR ESSENTIALLY NON-OSCILLATORY (ENO) APPROXIMATIONS, THE NEED FOR NONLINEAR APPROXIMATIONS TO LINEAR PROBLEMS, AND COMPRESSIVE METHODS. A BREAKTHROUGH METHOD FOR PROBLEMS INVOLVING SHOCK-TURBULENCE INTERACTION, WHERE BOTH DISCONTINUITIES AND DETAILED FINE STRUCTURES ARE FOUND, INVOLVES USING HIGH ORDER ENO SCHEMES (1). THESE TECHNIQUES SHALL BE SUITABLY MODIFIED AND APPLIED TO THE COMPUTER RECONSTRUCTION AND ENHANCEMENT OF SIGNALS. THESE METHODS ARE LOCAL, NONLINEAR, AND INVOLVE THE DISCRETIZATION OF NEW, NONLINEAR, TIME DEPENDENT, PARTIAL DIFFERENTIAL EQUATIONS. THEY ARE "RINGING" FREE -- SUPPRESSING SPUROUS "GHOSTS" (OSCILLATIONS) AND ARE CAPABLE OF REMOVING LARGE NOISE TO SIGNAL TO RATIOS, BLURRING TO SIGNAL RATIOS, AND CAN RESOLVE MULTIPLE SCALES. THEY ARE ALSO PERFECTLY SUITED FOR PARALLEL COMPUTERS.

COGNITIVE SYSTEMS INC
234 CHURCH ST
NEW HAVEN, CT 06510
CONTRACT NUMBER:
ROGER C SCHANK
TITLE:

CBR IN THE CONTEXT OF ALBM: THE USE OF CASE-BASED REASONING TO
ENHANCE CONVENTIONAL KNOWLEDGE-BASED SYSTEMS
TOPIC# 38 OFFICE: PM/SBIR IDENT#: 33862

CASE-BASED REASONING (CBR) REPRESENTS A POWERFUL NEW PARADIGM FOR BUILDING EXPERT SYSTEMS THAT PROMISES TO OFFER MANY ADVANTAGES IN REDUCING THE TIME AND COST OF KNOWLEDGE-ENGINEERING, IN SIMPLIFYING SYSTEM MODIFICATION, AND IN AUTOMATING DOMAINS THAT RESIST REPRESENTATION IN RULES OR FRAMES. COGNITIVE SYSTEMS PROPOSES TO EXPLORE THE PRACTICALITY OF THESE AND OTHER PROMISED ADVANTAGES FOR CBR IN THE CONTEXT OF AIR LAND BATTLE MANAGEMENT (ALBM), A EXPERT SYSTEM

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THAT WILL HELP TO MAKE THE PERFORMANCE ISSUES FOR ALTERNATIVE TECHNOLOGIES CONCRETE. COGNITIVE HAS ALREADY DEVELOPED A TOOL FOR BUILDING CBR SYSTEMS AND HAS USED THAT TOOL TO DEVELOP A CBR BATTLE PLANNING APPLICATION WITH SOME PARALLELS TO ALBM. COGNITIVE WILL DRAW UPON THESE APPLICATIONS AND TOOLS TO IDENTIFY POTENTIAL AREAS FOR CBR ENHANCEMENT TO ALBM. SUCH ENHANCEMENTS MAY EXIST AS SUB-SYSTEMS FOR HANDLING RESISTANT PROBLEMS, DUPLICATE MODULES FOR ENHANCEMENTS IN PROCESSING TIME OR COMPONENTS FOR EXCEPTION PROCESSING. COGNITIVE WILL USE THIS EVALUATION TO PROVIDE A BLUEPRINT FOR PHASE II CBR ENHANCEMENTS TO ALBM. IN ADDITION, COGNITIVE WILL ASSESS THE AVAILABILITY OF DATA FOR CASE BASES. IF DATA IS AVAILABLE IN A DATABASE FORMAT WHICH MAY BE READILY DOWN-LOADED INTO A CASE BASE, COGNITIVE WILL DEVELOP A PROTOTYPE TO BE USED TO DEVELOP COMPARATIVE CBR/RULE-BASED PERFORMANCE DATA.

COMPOUND ENGINE CONSULTANTS INC
4517 E CALLE VENTURA
PHOENIX, AZ 85018
CONTRACT NUMBER:
C E BRADLEY

TITLE:
HYPERGOLIC FUEL INJECTOR FEATURES INCREASED UTILITY FOR REMOTELY PILOTED VEHICLES (RPVs) INCREASED RANGE ENDURANCE PAYLOAD MULTI..
TOPIC# 20 OFFICE: PM/SBIR IDENT#: 33860

A HYPERGOLIC FUEL INJECTOR IS DESCRIBED THAT ENABLES MULTIFUEL OPERATION, LOWER FUEL CONSUMPTION, AND ENHANCED ALL WEATHER STARTING FOR INTERNAL COMBUSTION ENGINES. THE DEVICE EMPLOYS A NOVEL DUAL FUNCTION HIGH PRESSURE PUMP PERMITTING THE TRANSPORT OF HEATED FUEL IN A FUEL INJECTOR SUITABLE FOR USE IN SUCH ENGINES. HIGH TEMPERATURE AND VERY HIGH PRESSURE FUEL IS DELIVERED TO THE COMBUSTION SPACE OF SUCH ENGINES WHERE SELF IGNITION OF THE FUEL OCCURS RESULTING IN IMPROVED COMBUSTION AND GREATER FLEXIBILITY IN ENGINE OPERATION AND CHOICE OF FUEL STOCKS. THE DEVICE IS SUITABLE FOR USE IN DIESEL, GAS TURBINE, AND SPARK IGNITION ENGINES. ENGINES SO EQUIPPED TO USE MULTIPLE FUELS WILL NOT BE LIMITED TO USE ONLY THOSE SPECIALIZED FUELS NOW DESIGNATED FOR USE IN THE VARIOUS TYPES, SUCH AS GASOLINE, DIESEL, AND JET FUELS. USE OF THE DEVICE WILL INCREASE PERFORMANCE AND LOWER THE EMITTED REGULATED AIR POLLUTANT EMISSIONS BELOW

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CURRENT ACHIEVED LEVELS. OTHER SIGNIFICANT BENEFITS ARE DESCRIBED.

CREARE INC
PO BOX 71
HANOVER, NH 03755
CONTRACT NUMBER:
BHARATAN R PATEL
TITLE:
LOW OBSERVABLE TECHNOLOGY FOR INFRARED SUPPRESSION ON AIRCRAFT
TOPIC# 22 OFFICE: PM/SBIR IDENT#: 33852

THE OBJECTIVE OF THE PROPOSED WORK (PHASE I AND II) IS TO DEVELOP A COMPUTER PROGRAM THAT WILL AID IN THE DESIGN OF EXHAUST COOLING SYSTEMS FOR INFRARED SUPPRESSION ON AIRCRAFT. THE CODE WILL BE CAPABLE OF MODELING COMPLEX THREE-DIMENSIONAL FLOW AND HEAT TRANSFER AND WILL BE GENERAL ENOUGH SO AS TO BE USED IN A WIDE VARIETY OF PROBLEMS ASSOCIATED WITH AIRCRAFT PROPULSION, E.G., VSTOLV. THE SOFTWARE WILL BE BASED ON CREARE'S FLUID FLOW MODELING CODE FLUENT/BFC. IN PHASE I, WE WILL DEVELOP THE SPECIFICATIONS FOR THE ENHANCEMENTS TO BE ADDED TO THE PROPOSED CODE. TO DEMONSTRATE THE CURRENT CAPABILITIES OF FLUENT/BFC, WE WILL COMPUTE THE THREE-DIMENSIONAL TURBULENT FLOW IN A TYPICAL VENTRAL NOZZLE CONFIGURATION. FINALLY, TO MEET THE SPECIFICATIONS, WE WILL DEVELOP A PLAN FOR THE IMPLEMENTATION OF NEW FEATURES AND CAPABILITIES THAT ARE NOT AVAILABLE IN THE BASE CODE.

CRYSTALLUME
125 CONSTITUTION DR
MENLO PARK, CA 94025
CONTRACT NUMBER:
DR K V RAVI
TITLE:
CVD DIAMOND COATINGS FOR FIBERS AND PARTICULATES IN HIGH TEMPERATURE COMPOSITES
TOPIC# 37 OFFICE: PM/SBIR IDENT#: 33885

AMONG THE EMERGING MATERIALS OF INTEREST, DIAMOND FILMS DEPOSITED BY

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PLASMA ENHANCED CVD (PECVD) OFFERS GREAT PROMISE AS A FIBER COATING IN FIBER-MATRIX COMPOSITES. DIAMOND FILMS POSSESS UNSURPASSED PHYSICAL PROPERTIES INCLUDING VERY HIGH THERMAL CONDUCTIVITY, HIGH ELECTRICAL RESISTIVITY, EXTREME HARDNESS, AND CHEMICAL INERTNESS. USED AS A COATING FOR REINFORCING FIBERS IN HIGH TEMPERATURE METAL MATRIX OR CERAMIC MATRIX COMPOSITES, THESE PROPERTIES CAN SOLVE A NUMBER OF PROBLEMS ENCOUNTERED WITH THESE COMPOSITE MATERIALS. AS AN EXTREMELY INERT COATING DIAMOND CAN STABILIZE THE FIBER-MATRIX INTERFACE AND PREVENT UNWANTED CHEMICAL REACTIONS BETWEEN THE FIBER AND THE MATRIX, WHILE ITS HIGH THERMAL CONDUCTIVITY CAN REDUCE THE THERMAL STRESSES FOUND IN SOME APPLICATIONS. THE OBJECTIVE OF THIS PHASE I RESEARCH PROGRAM IS TO DEMONSTRATE THE FEASIBILITY OF USING DIAMOND AS A FIBER COATING. DIAMOND FILMS WILL BE SYNTHESIZED ON PLANAR AND FIBER FORMS OF SiC, GRAPHITE AND A SILICON-NITROGEN CERAMIC. THE CHEMICAL, STRUCTURAL, AND ADHESIVE CHARACTERISTICS OF THE FILMS WILL BE RELATED TO THE DEPOSITION CONDITIONS, SUBSTRATE MATERIAL, AND CONDITION TO THE SUBSTRATE SURFACE. THE GOAL IS ESTABLISHED THE CONDITIONS UNDER WHICH CONTINUOUS, HIGH QUALITY DIAMOND COATINGS OF FIBERS CAN BE ACHIEVED. TO ESTABLISH THE IMPROVEMENT CONFERRED BY THE DIAMOND FILM, TESTS WILL BE MADE OF THE IMPROVED THERMAL CONDUCTIVITY OF DIAMOND COATED FIBERS.

DAEDALUS RESEARCH INC
2101 CRYSTAL PLAZA ARCADE - #110
ARLINGTON, VA 22202

CONTRACT NUMBER:

EDWARD H ALLEN

TITLE:

FEASIBILITY OF ROUGH TERRAIN/WILD WEATHER BASING OF SLAVED TANDEM FREEWING (STF) UAVs

TOPIC# 20 OFFICE: PM/SBIR IDENT#: 33796

A SLAVED TANDEM FREEWING (STF) AIRCRAFT IS A NOVEL, TANDEM WING, V/STOL AIR VEHICLE CONFIGURATION WITH UNIQUE POTENTIAL FOR SELF-LAUNCHING AND SELF-RECOVERY FROM BASES WITHOUT FLAT AND EVEN PLATFORMS (ROUGH TERRAIN) DURING PERIODS WHEN WIND VECTORS ARE GUSTY, LARGE AND ALIGNED IN THE MOST ADVERSE DIRECTION (WILD WEATHER). THIS STUDY WILL EVALUATE THE POTENTIAL OF STF AIRFRAMES TO SATISFY THIS ROUGH AND WILD BASING CRITERION AND EXAMINE POTENTIAL

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MODIFICATIONS OF CURRENT STF DESIGNS TO IMPROVE THE DEGREE TO WHICH CURRENT CONFIGURATIONS SATISFY THE CRITERION. THE WORK WILL INCLUDE AN ANALYSIS OF THE ROUGH AND WILD BASING PROBLEM AS RELATED TO THE STF CONFIGURATION AND OF THE BENEFITS TO UAV CAPABILITIES OF ITS SOLUTION, A PRELIMINARY DESIGN STUDY OF SELECTED ROUGH AND WILD ENHANCEMENTS TO STF DESIGNS, AND A SUB-SCALE FLIGHT TEST EVALUATION OF THOSE ENHANCEMENTS. THE EXPECTED RESULT IS A REPORT SUMMARIZING THE FEASIBILITY OF THE DESIGN OBJECTIVE.

DEFENSE SYSTEMS CONCEPTS (DSC)

1340 ASHTON RD - STE A

HANOVER, MD 21076

CONTRACT NUMBER:

JEFFREY A KRUTH

TITLE:

ACOUSTIC CHARGE TRANSPORT BASED EW SUBSYSTEMS

TOPIC# 8 OFFICE: PM/SBIR IDENT#: 33859

THE ACOUSTIC CHARGE TRANSPORT (ACT) DEVICE IS A RELATIVELY NEW COMPONENT, FABRICATED IN MONOLITHIC FORM ON GaAs, THAT OFFERS TREMENDOUS POTENTIAL FOR CURRENT/FUTURE SIGNAL PROCESSING SYSTEMS. BECAUSE OF ITS NEWNESS, LITTLE SYSTEMS APPLICATION WORK HAS BEEN PERFORMED TO-DATE. THE AREAS OF GREATEST POTENTIAL ARE IN RADAR, SONAR, AND PARTICULARLY, ELECTRONIC WARFARE (EW). IN ORDER TO EXPLOIT THIS DEVICE FULLY, SYSTEM DESIGN WORK MUST BE UNDERTAKEN TO DEVELOP CIRCUITS AND SUBSYSTEMS THAT CAN BE REALIZED EVENTUALLY IN A FULLY MONOLITHIC FORM. IT IS PROPOSED THAT THE ACT DEVICE BE ANALYZED FROM A EW SYSTEMS APPLICATION VIEWPOINT AND ALL PERTINENT CHARACTERISTICS ADDRESSED SO THAT SEVERAL KEY BUILDING BLOCK DESIGNS CAN BE EVOLVED, AIMED AT A PHASE II FABRICATION EFFORT. MEMORY AND FILTERBANK APPLICATIONS ARE CHOSEN AS TWO OF THE MOST POTENTIALLY REWARDING AREAS OF EXPLOITATION. KNOWLEDGE GAINED ON PREVIOUS ACT EFFORTS WILL BE BROUGHT TO BEAR AND PAST CONTACT WITH EDI, THE FOREMOST ACT DEVELOPMENT LABORATORY, WILL ASSIST IN GAINING ACCESS TO THE CURRENT STATE-OF-THE-ART IN ACT DEVELOPMENT. PRELIMINARY DESIGNS DEVELOPED FOR PAST APPLICATION PROVIDE A STARTING POINT FOR THE PROPOSED EFFORT, SAVING TIME AND YIELDING AN EXCELLENT JUMPING-OFF POINT FOR A PHASE II FOLLOW-ON.

DLA INC

3000 NEWCASTLE

ANN ARBOR, MI 48104

CONTRACT NUMBER:

DONALD S LOWE

TITLE:

MAPPING GEOLOGICAL AND GEOPHYSICAL FEATURES OF THE EARTH FROM SPA
MULTISPECTRAL DATA

TOPIC# 2 OFFICE: PM/SBIR IDENT#: 33857

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MINERAL MAPPING USING MULTISPECTRAL REMOTE SENSING TECHNIQUES HAS ATTRACTED MANY INVESTIGATIONS SINCE THE EARLY WORK OF MULTISPECTRAL LUNAR MAPPING BY HUNT AND HIS COLLEAGUES AT THE AF GEOPHYSICS LABORATORY IN CAMBRIDGE, MASSACHUSETTS. MOST NOTABLE ARE THE ACTIVITIES OF LYON (STANFORD UNIVERSITY), SALISBURY, ROWAN AND BAILEY (USGS), GOETZ AND KAHLE (JPL), AND THE GEOSAT COMMITTEE INVESTIGATIONS. THE WORK OF THESE INVESTIGATORS ADDRESSED FEATURE IDENTIFICATION BY SPATIAL PATTERN RECOGNITION (TOPOGRAPHY, DRAINAGE, FRACTURES, ETC.), SPECTRAL PATTERN RECOGNITION (RESTORATION, BROADBAND REFLECTANCE, GEOBOTANICAL PHENOMENA, AND ALTERATIONS), AND TEMPORAL VARIATIONS (SEASONAL AND HEAT CAPACITY). SPECTRAL PATTERN RECOGNITION INVESTIGATIONS EMPLOY IMAGE PROCESSING TECHNIQUES SUCH AS BAND RATIOING, SUPERVISED AND UNSUPERVISED CLUSTERING AND CLASSIFICATION, PRINCIPAL COMPONENT ANALYSIS, AND CONTRAST ENHANCEMENTS. THIS STUDY BUILDS UPON THESE PAST ACTIVITIES AND WILL INVESTIGATE THE UTILITY OF THREE NEW ADDITIONAL APPROACHES TO GEOLOGICAL FEATURE ENHANCEMENT; USE OF TWO NOVEL TECHNIQUES FOR SUBTRACTING SPECTRAL RADIANCE ASSOCIATED WITH SPARSE VEGETATION COVER (VEGETATION REFLECTANCE AND SCATTERING), MERGING LANDSAT THERMAL WITH REFLECTANCE DATA, AND MAXIMIZING SPECTRAL CONTRAST THROUGH A UNIQUE METHOD EMPLOYING A BRIGHTNESS/GREENESS TRANSFORMATION. THE RESULTING IMAGERY WILL BE EVALUATED AGAINST A WELL DOCUMENTED TEST SITE IN THE WESTERN UNITED STATES.

DLA INC
3000 NEWCASTLE RD
ANN ARBOR, MI 48104
CONTRACT NUMBER:
DONALD S LOWE

TITLE:
REMOTE SENSING OF UNDERGROUND NUCLEAR EXPLOSIONS
TOPIC# 3 OFFICE: PM/SBIR IDENT#: 33858

LARGE NUCLEAR UNDERGROUND EXPLOSIVES GENERATE EXTREMELY HIGH PRESSURE FORCES AND COMPRESSIONAL WAVES WHICH INTERACT WITH THE OVERLYING MATERIALS. UNDER MOST CONDITIONS A PERMANENT SURFACE DEFORMATION OCCURS, BUT THE EXACT NATURE DEPENDS UPON THE LOCAL GEOLOGY. THE DETECTABILITY BY SYNTHETIC APERTURE RADAR (SAR) AND MULTISPECTRAL

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IMAGERY (MSI) IS ULTIMATELY DEPENDENT UPON THE SURFACE EXPRESSION AS EXHIBITED BY SLOPE, TEXTURE, FRACTURES, AND BOTH LONG AND SHORT TERM CHANGES IN VEGETATION. THE PURPOSED STUDY WILL INVESTIGATE THE FEASIBILITY OF IDENTIFYING LARGE NUCLEAR UNDERGROUND EXPLOSIONS USING REMOTE SENSING TECHNIQUES. WHILE THE STUDY WILL USE ANY AND ALL DATA THAT ARE AVAILABLE OVER THE NEVADA NUCLEAR TEST SITE, EMPHASIS WILL BE GIVEN TO THE ULTIMATE ABILITY TO DETECT AND MAP REMOTELY UNDERGROUND EXPLOSIONS OCCURRING IN DENIED AREAS USING CHANGE DETECTION PROCEDURES AND SATELLITE OBSERVATIONS.

DYNA EAST CORP
3201 ARCH ST
PHILADELPHIA, PA 19104
CONTRACT NUMBER:
DR PEI CHI CHOU

TITLE:

THE EFFECTS OF ANISOTROPY ON SLUG FORMATION OF TANTALUM EFP'S
TOPIC# 14 OFFICE: PM/SBIR IDENT#: 33828

IT IS WELL-KNOWN THAT A SLIGHT VARIATION IN THE LINER MATERIAL PROPERTIES MAY CHANGE THE SHAPE OF THE SLUG. THE EXACT MECHANISM OF THIS IS STILL NOT CLEARLY UNDERSTOOD, BUT ONE REASON FOR THIS OCCURRENCE IS ANISOTROPIC BEHAVIOR. ANISOTROPY, DEFINED AS THE DIRECTIONAL DEPENDENCE OF PROPERTIES, IS GENERALLY CAUSED BY AN INHOMOGENEOUS TEXTURE IN THE MATERIAL. DYNA EAST PROPOSES TO DETERMINE THE CAUSE AND AFFECT RELATIONSHIP BETWEEN EFP FABRICATION METHODS, MATERIAL ANISOTROPY, AND EFP PERFORMANCE. DIFFERENT FABRICATION METHODS WILL BE USED TO FORM LINER PREFORMS, AND THE RELATIVE ANISOTROPY (BASED ON DIRECTIONAL MECHANICAL STRENGTH PROPERTIES) CREATED BY EACH PROCESS WILL BE STUDIED. THESE RESULTS WILL BE USED AS INPUT TO A COMPUTER CODE TO PREDICT RESULTING EFP SLUG PROPERTIES. CODE PREDICTIONS WILL BE COMPARED TO ACTUAL TEST RESULTS, AND THE CODE WILL BE MODIFIED AS NECESSARY. THUS, FOR A GIVEN SET OF ANISOTROPIC CHARACTERISTICS, THE CODE WILL BE ABLE TO PROVIDE SUCH INFORMATION AS SLUG SHAPE. IN REVERSE, THE PROPOSED WORK WILL HELP ESTABLISH WHICH FABRICATION METHOD SHOULD BE USED IN ORDER TO ACHIEVE A SPECIFIC DESIRABLE SLUG SHAPE.

ELECTRONIC DECISIONS INC
1776 E WASHINGTON ST
URBANA, IL 61801
CONTRACT NUMBER:
DANIEL A FLEISCH

TITLE:

ACT PATTERN MATCHING SYSTEM

TOPIC# 8 OFFICE: PM/SBIR IDENT#: 33832

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IN VERY DENSE ELECTROMAGNETIC SIGNAL ENVIRONMENTS, A FAST ANALOG PREPROCESSOR MAY BE OF SIGNIFICANT VALUE IN REDUCING THE BURDEN OF A/D CONVERTERS AND DIGITAL PROCESSORS AND MAY SUBSTANTIALLY REDUCE RESPONSE TIME IN EW SYSTEMS. THIS PROPOSAL SEEKS TO DESIGN AND EVALUATE AN ANALOG PATTERN-MATCHING SYSTEM BASED ON THE EMERGING TECHNOLOGY OF ACOUSTIC CHARGE TRANSPORT (ACT). THIS SYSTEM MAY BE USED TO SCREEN SIGNALS FROM A MULTICHANNEL ESM RECEIVER PRIOR TO A/D CONVERSION, THEREBY REDUCING THE DIGITAL PROCESSING BURDEN BY 2 TO 3 ORDERS OF MAGNITUDE. THE PROPOSED SYSTEM USED GaAs IC ANALOG PROCESSORS WHICH ARE WELL-SUITED TO ON-BOARD ESM SYSTEMS. THE PROPOSED CONCEPT DEMONSTRATION PROGRAM WILL BE ACCOMPLISHED IN 2 PHASES; THIS PHASE I PROPOSAL COVERS THE INITIAL SYSTEM DESIGN AND EVALUATION TO THE PERFORMED USING DATA TAKEN FROM EXISTING ACT DEVICES AND INSERTED INTO A PERFORMANCE MODEL FOR THE OPERATIONAL SYSTEM.

ENSCO INC
5400 PORT ROYAL RD
SPRINGFIELD, VA 22151
CONTRACT NUMBER:
DR DOUGLAS R BAUMGARDT
TITLE:
CHARACTERIZING SEISMIC EVENTS USING ARTIFICIAL NEURAL SYSTEMS
TOPIC# 4 OFFICE: PM/SBIR IDENT#: 33822

THIS STUDY WILL INVESTIGATE THE FEASIBILITY OF APPLYING NEURAL NETWORK METHODS FOR THE EXTRACTION OF SEISMIC WAVEFORM CHARACTERISTICS AND THE IDENTIFICATION OF SEISMIC EVENTS. THE SPECIFIC OBJECTIVES IN THIS INITIAL STUDY WILL BE TO DEVELOP A NEURAL NETWORK WHICH WILL RECOGNIZE THE SEISMIC SIGNAL CHARACTERISTICS OF DELAYED BLASTING (RIPPLE FIRING) IN ECONOMIC EXPLOSIONS AND CHARACTERIZED THE RIPPLE-FIRE PATTERNS, IN TERMS OF NUMBER OF EXPLOSIONS, RELATIVE DELAY TIME, AND RELATIVE YIELDS, FROM THE SPECTRA AND CEPSTRA OF THE SIGNALS. A CONSTRAINED NEURAL NETWORK ARCHITECTURE WITH HIDDEN UNITS WILL BE USED. THE INPUT NODES WILL BE THE RIPPLE FIRED BLAST. TRAINING WILL BE ACCOMPLISHED BY PRE-SENTING AS INPUT TO THE NEURAL NETWORK CEPSTRAL FEATURES FOR SEISMIC SIGNALS FROM BLASTS WITH KNOWN RIPPLE FIRE CHARACTERISTICS AND

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CONSTRAINING THE OUTPUT TO BE THE RIPPLE FIRE PARAMETERS. THE WIDROW BACKPROPAGATION METHOD WILL BE USED TO SET THE WEIGHTS ON THE INTERCONNECTED HIDDEN NODES IN THE TRAINING PROCESS. AFTER TRAINING, THE NEURAL NETWORK WILL PRODUCE THE DESIRED RIPPLE FIRE PATTERN WHEN PRESENTED THE SAME CEPSTRAL FEATURES. INITIAL TESTING OF THIS ALGORITHM WILL BE ACCOMPLISHED WITH SYNTHETIC SIGNAL FEATURES FOR ASSUMED REALISTIC RIPPLE FIRING CONFIGURATIONS.

ENSCO INC
5400 PORT ROYAL RD
SPRINGFIELD, VA 22151
CONTRACT NUMBER:
DR DOUGLAS R BAUMGARDT
TITLE:
KNOWLEDGE BASED SEISMIC EVENT IDENTIFICATION USING SEISMIC ANALYSIS
CASE KNOWLEDGE AND EXPLANATIONS
TOPIC# 1 OFFICE: PM/SBIR IDENT#: 33831

THIS STUDY WILL INVESTIGATE THE APPLICABILITY OF CASE-BASED REASONING TO THE DOMAIN OF SEISMIC EVENT IDENTIFICATION FOR MONITORING TESTBAN TREATIES. A SEISMIC IDENTIFICATION DECISION SUPPORT TOOL WILL BE DEVELOPED TO UTILIZE CASE KNOWLEDGE FROM PREVIOUS EVENTS WHICH HAVE BEEN IDENTIFIED TO IDENTIFY NEW EVENTS WHICH MATCH THE CASE EVENTS. THE CASES, TAKEN FROM THE LITERATURE OR FROM ANALYSIS OF ACTUAL DATA, WILL DESCRIBE HOW A SEISMOLOGIST IDENTIFIED A PARTICULAR EVENT OR GROUP OF EVENTS, INCLUDING WHAT DATA WAS USED, WHAT ANALYSES WERE PERFORMED, AND HOW THE FINAL DECISION WAS MADE. OLD CASES WILL BE SELECTED FOR MATCHING TO NEW CASES THROUGH INDEXED FEATURES, AND THE NEW EVENTS WILL BE CHARACTERIZED AND IDENTIFIED ACCORDING TO THE SIMILARITY OF SIGNAL FEATURES TO THOSE OF THE CASE EVENTS. CONCEPTUAL/DYNAMIC MEMORY STRUCTURES WILL BE DESIGNED TO REPRESENT SEISMOLOGICAL CONCEPTS AND TO ORGANIZE CASE DATA AROUND THE CONCEPTS. EXPLANATION-BASED LEARNING METHODS WILL BE EXPLORED FOR AUTOMATIC INDEXING AND GENERALIZATION OF CASE KNOWLEDGE. WHEN IMPLEMENTED ON A COMPUTER, THE SYSTEM WILL AUTOMATICALLY ANALYZE SEISMIC EVENTS, IN THE SAME MANNER AS SEISMOLOGISTS WHO INVESTIGATE UNIDENTIFIED AND SPECIAL EVENTS, AND BE ABLE TO EXPLAIN ITS RESULTS ABOUT THE NEW EVENT WITH THE CONTEXT OF PREVIOUS CASES.

EPSILON LAMBDA ELECTRONICS CORP
427 STEVENS ST
GENEVA, IL 60134
CONTRACT NUMBER:
ROBERT M KNOX
TITLE:
INNOVATIVE MANUFACTURING TECHNOLOGY FOR REDUCING COSTS OF GUIDED MUNITIONS
TOPIC# 15 OFFICE: PM/SBIR IDENT#: 33827

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AN INNOVATIVE APPROACH TO REDUCING THE TOTAL LIFE CYCLE COST OF OWNERSHIP OF GUIDED MUNITIONS IS PROPOSED. FOCUS OF THE APPROACH IS ON THE MANUFACTURING TECHNOLOGY APPLIED TO A MILLIMETER WAVE TARGET SEEKER FRONT END (TRANSMITTER, RECEIVER AND ANTENNA). COST REDUCTION IN LARGE SCALE MANUFACTURING IS POSSIBLE THROUGH USE OF THE FIBER INTEGRATED MILLIMETRICS, A CIRCUIT METHOD WHICH ALLOWS COMPUTER AUTOMATED SURFACE MOUNTING OF ALL COMPONENTS AND DEVICES. THE PROPOSED APPROACH WILL INTRODUCE STANDARDS INTO THE CIRCUIT DESIGN APPROACH SUCH THAT ENGINEERING DEVELOPMENT COSTS WILL ALSO BE REDUCED. FRONT END QUALITY ENHANCEMENT THROUGH COMPUTER INTEGRATED MANUFACTURING WILL NOT ONLY LOWER PRODUCT COST BUT MINIMIZE COST OF OWNERSHIP THROUGH EXTENDED SHELF LIFE. A COMPREHENSIVE FOUR YEAR PROGRAM IS ENVISIONED LEADING TO A VALIDATED AND OPERABLE MANUFACTURING FACILITY CAPABLE OF MASS PRODUCING UNDER AUTOMATED COMPUTER CONTROL A VARIETY OF MILLIMETER WAVE FRONT END CONFIGURATIONS AT SUBSTANTIALLY LOWER COST THAN MORE CONVENTIONAL METHODS. THE PHASE I PROGRAM WILL INVOLVE COST MODELING TO QUANTIFY POTENTIAL BENEFITS OF THE PROPOSED FACILITY METHODS.

EXCEL TECHNOLOGY INC
140-20 KEYLAND CT
BOHEMIA, NY 11716
CONTRACT NUMBER:
DR RAMA RAO
TITLE:

SIS QUANTUM DETECTOR IN THE 1-10 MICRON REGION FABRICATED BY
SEQUENTIAL DEPOSITION OF THIN FILMS OF HIGH Tc Bi-Ca-Sr-Cu-O
TOPIC# 19 OFFICE: PM/SBIR IDENT#: 33794

IN THE PROPOSED PROGRAM, FOR THE FIRST TIME, FEASIBILITY OF DEVELOPING AND CHARACTERIZING A HIGHLY SENSITIVE AND HIGH SPEED QUANTUM DETECTOR IN THE 1-10 μ WAVELENGTH REGION USING A SUPERCONDUCTING SIS TYPE WEAK LINK OF Bi-Ca-Sr-Cu-O, IS EXAMINED. THE DETECTION PRINCIPAL IS BASED ON THE FACT THAT THE ABSORBED INFRARED RADIATION REDUCES THE ENERGY GAP OF THE SUPERCONDUCTOR, MODIFYING THE CURRENT-VOLTAGE CHARACTERISTICS OF JOSEPHSON JUNCTION WHICH CAN SERVE AS A USEFUL DETECTOR OUTPUT. RECENTLY, IN A PRELIMINARY EXPERIMENT, WE HAVE OBSERVED FOR THE FIRST TIME, NOT ONLY A SLOW BOLOMETRIC RE-

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SPONSE BUT ALSO A FAST NON-THERMAL QUANTUM RESPONSE DUE TO COOPER PAIR BREAKING AND QUASI-PARTICLES GENERATION IN YBa-Cu-O FILM SUBJECTED TO PULSED 532 nm LASER. IN THE PRESENT WORK, PRECISELY CONTROLLED SUPERCONDUCTING, INSULATING, AND SUPERCONDUCTING THIN FILMS OF Bi-Ca-Sr-Cu-O WILL BE DEPOSITED ON A SUITABLE SUBSTRATE BY PLASMA ASSISTED LASER DEPOSITION USING 265 nm UV LASER AT 10 Hz. SUBSEQUENT TO A DEPOSITION, SUPERCONDUCTING WEAK LINK SIS TYPE JOSEPHSON JUNCTION WILL BE FABRICATED BY PATTERNING THESE FILMS WITH 532 nm VISIBLE LASER AT 1 KHz. FOR DETECTION, INFRARED RADIATION FROM Nd:YAG LASER AT 1.06 μ WILL BE MODULATED AND GUIDED THROUGH AN OPTICAL FIBER TO THE DETECTOR. IN THE PHASE I, NON-EQUILIBRIUM (QUANTUM) RESPONSE OF THE DETECTOR AT 1.06 μ AND THE TEMPERATURE DEPENDENCE OF THE RESPONSE WILL BE STUDIED. THE RESPONSIVITY OF THE DETECTOR IS ESTIMATED TO BE $\sim 10(4)$ V/W, WHICH IS SEVERAL ORDERS OF MAGNITUDE HIGHER THAN PRESENTLY AVAILABLE QUANTUM DETECTORS. IN PHASE II, WAVELENGTH DEPENDENCE OF THE RESPONSE IN THE 1-10 μ REGION, HIGH FREQUENCY RESPONSE, AND THE TEMPERATURE DEPENDENCE OF THE RESPONSIVE TIME WILL BE INVESTIGATED.

FOSTER-MILLER INC

350 SECOND AVE

WALTHAM, MA 02254

CONTRACT NUMBER:

TED KIRCHNER

TITLE:

HIGH EFFICIENCY SEAM-BONDING FOR ORDERED POLYMER

LIGHTER-THAN-AIR-STRUCTURES

TOPIC# 21 OFFICE: PM/SBIR IDENT#: 33804

HEAVY, MULTI-PLY, LIMITED LIFE LIGHTER-THAN-AIR (LTA) VEHICLE SKINS COULD BE REPLACED WITH A HIGH STRENGTH/TOUGH, GAS IMPERMEABLE 2-PLY ORDERED POLYMER LAMINATE. THIS WOULD RESULT IN FACTORS OF 3 TO 10 REDUCTION IN LTA VEHICLE OR SKIN WEIGHT, WHICH WOULD TRANSLATE LINEARLY TO GREATER PAYLOAD AND RELATED PERFORMANCE. THE PROPOSED PHASE I PROGRAM WILL DEVELOP AN EFFICIENT, RELIABLE AND SIMPLE-TO-FABRICATE ORDER POLYMER LTA SKIN JOINT. THIS JOINT AND THE FILM LAMINATE WILL BE VERIFIED BY TENSILE, IMPACT, FAA/NAVY RIP STOP, HANDLING AND GAS PERMEABILITY TESTS AS WELL AS A LONGER TERM UV TEST. A SUCCESSFUL TEST PROGRAM WILL FORM THE BASIS OF A PHASE II PROGRAM

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TO DESIGN, FABRICATE AND FLY AN ORDERED POLYMER AEROSTAT TO
DEMONSTRATE ITS SUPERIOR PERFORMANCE.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER:
UDAY KASHALIKAR
TITLE:
TAILORED COATINGS FOR Gr/TiAl COMPOSITES FOR HIGH TEMPERATURE
STRUCTURES
TOPIC# 37 OFFICE: PB/SBIR IDENT#: 33816

THE INNOVATION WE PROPOSE IS A NOVEL PRECERAMIC POLYMER ROUTE TO
THIN (< 1u) COATINGS OF NITRIDES AND CARBIDES ON GRAPHITE FIBERS TO
BE USED IN TITANIUM ALUMINIDE INTERMETALLIC COMPOSITES. IF SUCCESS-
FUL, THE COATINGS WILL PROVIDE AN EFFECTIVE BARRIER TO FIBER-MATRIX
REACTION AT HIGH PROCESSING AND SERVICE TEMPERATURES - A MAJOR CAUSE
OF DEGRADATION IN THESE NEW HIGH TEMPERATURE COMPOSITES. THE COAT-
INGS WILL ALSO PROVIDE A MEANS TO TAILOR THE INTERFACE AND THEREBY
TOUGHEN BRITTLE MATRIX COMPOSITES. THE PRECERAMIC POLYMER ROUTE
WILL UNIFORMLY COAT INDIVIDUAL FILAMENTS IN A CONTINUOUS, MULTIFILA-
MENT TOWS AT RELATIVELY LOW COST. ALSO, THIS APPROACH IS ADAPTABLE
TO A VARIETY OF FIBERS, MATRICES, AND COATINGS.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER:
BRUCE NAPPI
TITLE:
SOFT KILL OF FIELDDED WEAPON SYSTEMS
TOPIC# 27 OFFICE: PM/SBIR IDENT#: 33817

IN A CONVENTIONAL WAR, NEUTRALIZATION OF OPPOSING ARMOR IS A KEY
MILITARY OBJECTIVE. TRADITIONALLY, SUCH ACTION IS ACHIEVED BY
FIREPOWER. HOWEVER, OTHER METHODS (SOFT-KILL) ARE ALSO AVAILABLE;

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THESE METHODS HAVE THE ADVANTAGE THAT THEY DO NOT HAVE TO OVERCOME THE PROTECTIVE ARMOR OF OPPOSING COMBAT VEHICLES AND OTHER FIELDDED WEAPONS. THE WORK PROPOSED HEREIN IS AIMED AT INVESTIGATING A WIDE RANGE OF SOFT-KILL CONCEPTS WITH A VIEW OF SELECTING ONE OR MORE LEADING CONCEPTS FOR FURTHER DEVELOPMENT. INITIAL CONCEPT GENERATION WILL BE CARRIED OUT THROUGH A MORPHOLOGICAL MODEL FOR SOFT-KILL ATTACK. TARGET ARMORED VEHICLES (AND FIELDDED WEAPONS) WILL BE IDENTIFIED AND REPRESENTATIVE EXAMPLES SELECTED FROM FOUR PRIMARY CLASSES (TANKS, SELF-PROPELLED GUNS, MOBILE MISSILE LAUNCHERS AND ARMORED PERSONNEL CARRIERS). A VULNERABILITY ANALYSIS OF THE REPRESENTATIVE VEHICLES WILL BE CARRIED OUT. SOFT-KILL CONCEPTS THAT CAN EXPLOIT SPECIFIC VEHICLE VULNERABILITIES WILL BE IDENTIFIED AND IMPLEMENTATION SCHEMES FOR THESE CONCEPTS WILL BE FORMULATED. SUCH CONCEPTS AND THEIR IMPLEMENTATION WILL THEN BE EVALUATED ANALYTICALLY TO ASSESS THEIR FEASIBILITY AND PRACTICALITY OF USE UNDER BATTLEFIELD CONDITIONS. THE LEADING CONCEPT(S) WILL BE SELECTED FOR PROTOTYPE DEVELOPMENT AND TESTING IN PHASE II.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER:
LAWRENCE H DOMASH

TITLE:
LASER PROTECTION THROUGH ORGANIC NONLINEAR OPTICAL LIQUIDS
TOPIC# 47 OFFICE: PM/SBIR IDENT#: 33877

THE PROTECTION OF OPTICAL/IR SENSORS OF HUMAN EYES AGAINST LASER THREATS IS AN IMPORTANT UNSOLVED DEFENSE PROBLEM. THE MOST CHALLENGING NEED IS FOR AN OPTICAL LIMITER WITH PICOSECOND RESPONSE IN A FINITE WAVELENGTH BAND AGAINST SHORT PULSE, FREQUENCY-AGILE LASERS. OUR RESEARCH IS DIRECTED TOWARDS DEVICE APPLICATIONS OF NOVEL NONLINEAR OPTICAL LIQUIDS WITH PRECISE INDEX MATCHING PROPERTIES AND LARGE INTENSITY DEPENDENT REFRACTIVE INDEX EFFECTS. PHASE I RESEARCH WILL PREPARE ORGANIC LIQUIDS BASED ON HIGH SOLUBILITY, HIGH-BETA ORGANIC MOLECULES AND MEASURE THE PRECISION OF THEIR LINEAR INDEX MATCHING RANGE TO GLASS SUBSTRATES AND WAVEGUIDES. BASED ON THE RESULTS OF THESE EXPERIMENTS, THE FEASIBILITY OF A VARIETY OF POSSIBLE FIBER OPTIC FACEPLATE DESIGNS WILL BE EVALUATED

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BY THEORETICAL MODELING CALCULATIONS. PHASE II STUDIES WILL PROCEED TO CONSTRUCT AND DEMONSTRATE WORKING PROTOTYPES OF IMAGE-PLANE OPTICAL LIMITERS WITH PICOSECOND RESPONSE.

GEO-CENTERS INC
7 WELLS AVE
NEWTON CENTRE, MA 02159
CONTRACT NUMBER:
ALAN L CRANDALL
TITLE:
HUNTER/KILLER COUNTERMINE SYSTEM
TOPIC# 11 OFFICE: PM/SBIR IDENT#: 33805

GEO-CENTERS, INC. PROPOSES TO DESIGN, FABRICATE AND EVALUATE AN INTEGRATED TEST BED FOR THE DEMONSTRATION AND EVALUATION OF THE TECHNICAL ELEMENTS REQUIRED FOR A HUNTER/KILLER COUNTERMINE SYSTEM. SUCH A SYSTEM REQUIRES INTEGRATION OF DIVERSE TECHNOLOGIES INCLUDING MULTIPLE SENSOR AND DETECTION ALGORITHMS, REMOTE CONTROL AND NEUTRALIZATION TECHNOLOGY WHICH HAVE NOT PREVIOUSLY BEEN COMBINED IN A SINGLE SYSTEM. THIS PROGRAM WILL COMBINE RECENT RESULTS OF CURRENT EFFORTS IN EACH OF THESE TECHNICAL AREAS, AND WILL EVALUATE THE VARIOUS COMBINED SYSTEM OPTIONS. AS A STEP TOWARD THE PHASE II GOAL OF AN INTEGRATED TEST BED, THIS PHASE I SBIR PROGRAM WILL FOCUS ON THE DEMONSTRATION OF TARGET DETECTION USING MULTIPLE SENSORS AND THE SUBSEQUENT TARGET MARKING. WHILE TARGET DETECTION IS AN AREA OF ACTIVE RESEARCH, THE CRITICAL PROBLEMS OF REAL TIME TRACKING OF THE SPATIAL POSITION OF SUSPECTED TARGETS FOR MARKING OR NEUTRALIZATION HAVE BEEN NEGLECTED.

GEO-CENTERS INC
7 WELLS AVE
NEWTON CENTRE, MA 02159
CONTRACT NUMBER:
SHELDON S SANDLER
TITLE:
NEURAL NETWORKS APPLIED TO SEISMIC PROCESSING
TOPIC# 4 OFFICE: PM/SBIR IDENT#: 33838

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GEO-CENTERS, INC. PROPOSES TO DEMONSTRATE THE FEASIBILITY OF USING A NEURAL NETWORK TO ANALYZE SEISMIC DATA TO CLASSIFY EARTHQUAKES, NUCLEAR BLASTS, AND CHEMICAL BLASTS. USING TIME AND FREQUENCY DOMAIN INFORMATION FROM IDENTIFIED PHASES A NEURAL NETWORK WILL BE TAUGHT USING DATA AVAILABLE FROM THE CENTER FOR SEISMIC STUDIES. A MULTILAYER NEURAL NETWORK WILL BE EMPLOYED HAVING AN INPUT LAYER, A HIDDEN LAYER AND AN OUTPUT LAYER. A BACK PROPAGATION PROCEDURE WILL TRAIN THE NETWORK TO PERFORM THE MAPPING FROM PHASE DATA TO THE CORRECT CLASSIFICATION OF THE EVENT.

GRAHAM RESEARCH
4278 MECHANICSVILLE RD
BENSALEM, PA 19020
CONTRACT NUMBER:
DR WILLIAM J GRAHAM

TITLE:
FOCUSED COUNTERMINE ARRAY FOR MICROWAVE DETECTION AND DESTRUCTION
OF MINES
TOPIC# 11 OFFICE: PM/SBIR IDENT#: 33811

THIS PROPOSAL IS ADDRESSED TO THE PROBLEM OF DETECTING AND DISABLING LAND MINES USING FOCUSED MICROWAVE RADIATION. THE CONCEPT IS DIRECTED PRIMARILY TO SUBSURFACE ANTI-TANK MINES OF EITHER DIELECTRIC OR METALLIC COMPOSITION, ALTHOUGH IT IS ALSO APPLICABLE TO SURFACE MINES. THE INNOVATIVE CONCEPT PROPOSED IS THE USE OF A DIGITALLY FOCUSED AND SCANNED MICROWAVE ARRAY RADAR DETECTION SYSTEM USING BISTATIC OBLIQUE FORWARD SCATTERING TO REDUCE GROUND SURFACE REFLECTIONS. THE SYSTEM FORMS A HIGH RESOLUTION THREE-DIMENSIONAL IMAGE OF THE MEDIUM WHICH ALLOWS A MINE TO BE BOTH DETECTED AND IDENTIFIED BY ITS IMAGE. THE SYSTEM USED A HIGH POWER FOCUSED MICROWAVE ARRAY FOR DESTRUCTION OF THE MINE BY MICROWAVE HEATING. THE GOAL OF THE DETECTION SYSTEM IS TO OBTAIN BETTER THAN 5 CM RESOLUTION IN THREE DIMENSIONS, HIGH SPEED IMAGING OF THE MEDIUM AND TARGET ALLOWING A HIGH RATE OF FORWARD MOTION, AND SUB-SURFACE TRANSMISSION APPROACHING 100%. THE SYSTEM WILL ATTEMPT TO DISABLE THE MINE WITHOUT DETONATION ALLOWING A REDUCED STANDOFF DISTANCE. THE CONCEPT HAS THE POTENTIAL TO PROVIDE A UNIQUE METHOD OF HIGH SPEED, HIGH RESOLUTION MINE DETECTION WITH THE SAME FOCUSED ARRAY TECHNOLOGY BEING USED FOR

SUBMITTED BY

DESTRUCTION OF THE MINE.

HNC INC
5501 OBERLIN DR
SAN DIEGO, CA 92121
CONTRACT NUMBER:
SCOTT OLMSTED
TITLE:
SEISMIC EVENT IDENTIFICATION AND LOCATION USING NEURAL NETWORKS
TOPIC# 4 OFFICE: PM/SBIR IDENT#: 33870

HNC, INC. PROPOSES TO EVALUATE THE CLASSIFICATION CAPABILITIES OF NEURAL NETWORKS TO REAL SEISMIC DATA, SPECIFICALLY, TO DETERMINE WHETHER OR NOT NEURAL NETWORKS CAN IMPROVE UPON THE CURRENT CAPABILITY (USING STANDARD SEISMOLOGICAL AND STATISTICAL METHODS) TO IDENTIFY REGIONAL SEISMIC EVENTS. THE EMPHASIS IS ON AUTOMATED SIGNAL PROCESSING TO MAKE TRACTABLE THE ROUTINE CLASSIFICATION OF LARGE NUMBERS OF SEISMIC EVENTS. THE ULTIMATE PROJECT OBJECTIVE IS THE POSITIVE IDENTIFICATION AND LOCATION OF NUCLEAR TESTS FROM WITHIN A LARGE NUMBER OF EARTHQUAKES AND PEACEFUL (CHEMICAL) EXPLOSIONS. SCIENCE APPLICATIONS INTERNATIONAL CORPORATION (SAIC) WILL SUPPORT HNC BY PROVIDING REAL DATA AND ASSISTING WITH PROBLEM DEFINITION. AS A LARGE TRAINING SET OF SEISMIC RECORDINGS OF NUCLEAR TESTS ARE NOT AVAILABLE FOR THE GEOGRAPHIC REGIONS OF INTEREST, THE NETWORK WILL NOT BE ASKED TO IDENTIFY AN EVENT AS A NUCLEAR TEST BASED ON PAST EXPERIENCE. RATHER, THE NEURAL NETWORK WILL BE ASKED TO IDENTIFY EVENTS THAT ARE "DIFFERENT" FROM THOSE IT HAS EXPERIENCE WITH. THAT IS, IT SHOULD FIND EVENTS WITH A LOW PROBABILITY OF BEING IN ANY OF THE OUTPUT CLASSIFICATIONS OF THE NETWORK.

IAP RESEARCH INC
2763 CULVER AVE
DAYTON, OH 45429
CONTRACT NUMBER:
DAVID P BAUER
TITLE:
TECHNIQUE FOR EVALUATING THE EFFECT OF METALLURGY VARIABLES ON THE DYNAMIC STRENGTH OF HEAVY METAL LINEAR MATERIALS
TOPIC# 14 OFFICE: PM/SBIR IDENT#: 33886

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WE PROPOSE TO IDENTIFY THE EFFECT OF METALLURGY VARIABLES ON THE DYNAMIC STRENGTH OF TANTALUM (Ta) USING AN ELECTROMAGNETIC EXPANDING WIRE TECHNIQUE. OUR TECHNIQUE IS CAPABLE OF SIMULATING THE HIGH STRAIN RATE AND ELEVATED TEMPERATURE ENVIRONMENT EXPERIENCED BY ACTUAL SHAPED CHARGE LINEAR MATERIALS. THIS INFORMATION CAN ULTIMATELY BE USED TO PREDICT PARAMETERS SUCH AS SHAPED CHARGE JET BREAKUP.

IGR ENTERPRISES INC
23714 WOODWAY RD
BEACHWOOD, OH 44122
CONTRACT NUMBER:
DR ARNOLD GORDON
TITLE:

IGR POWER PACK

TOPIC# 20 OFFICE: PM/SBIR IDENT#: 33876

IGR ENTERPRISES, INC. HAS DEVELOPED, UNDER ITS INTERNAL CORPORATE RESEARCH AND DEVELOPMENT PROGRAM, A MILITARY ELECTRIC POWER PRODUCING TECHNOLOGY (THE "IGR POWER PACK") WHICH CAN POWER A RPV WITH A VERY HIGH ENERGY DENSITY, LOW SIGNATURE,, HIGH RELIABILITY AND SIMPLE LOGISTICS. THE IGR POWER PACK IS ALL SOLID STATE, IT CONTAINS NO MOVING PARTS. IT IS SIMPLE, EASY TO MANUFACTURE AND MECHANICALLY RUGGED. IT MAY USE VIRTUALLY ANY TYPE OF COMMON FUEL INCLUDING GASOLINE. THE PRIMARY OBJECTIVE OF THIS SBIR WORK EFFORT IS TO DEVELOP A PROTOTYPE OF SUFFICIENT SIZE TO ALLOW A QUANTITATIVE PERFORMANCE EVALUATION OF THIS NOVEL TECHNOLOGY, AND TO CARRY OUT DESIGN AND MISSION SIZINGS FOR A VARIETY OF DOD SPECIFIED PROFILES.

IM-TECH CO
12417 BUTTERNUT CIR
KNOXVILLE, TN 37922
CONTRACT NUMBER:
DR HUEY S HSU
TITLE:

PROCESSING AND FABRICATION OF SUPERCONDUCTING COMPOSITE WIRES
TOPIC# 32 OFFICE: PM/SBIR IDENT#: 33842

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THE RECENT DISCOVERY OF HIGH TEMPERATURE SUPERCONDUCTORS HAS LED TO RENEWED INTEREST IN THE LARGE-SCALE APPLICATION OF SUPERCONDUCTIVITY. THE PRIMARY OBSTACLE TO THE USE OF THESE MATERIALS IS THE PRESENT INABILITY TO PRODUCE MATERIAL IN USABLE FORMS WITH ADEQUATE CURRENT CARRYING ABILITY AND MECHANICAL PROPERTIES. THE PRESENT PROJECT INVOLVES INVESTIGATION OF THE FEASIBILITY OF FABRICATING SUPER-CONDUCTING OXIDE COMPOSITE WIRES WITH SUPERIOR MECHANICAL AND ELECTRICAL PROPERTIES USING A NOVEL APPROACH CENTERED ON ROOM TEMPERATURE DEFORMATION PROCESSING OF SPECIAL POWER MIXTURES. IF SUCCESSFUL, THE DEVELOPMENT OF SUCH TECHNOLOGY COULD QUICKLY TAKE ADVANCES IN CERAMIC SUPERCONDUCTORS TO THE MARKETPLACE.

IMAGING SCIENCE TECHNOLOGIES
PO BOX 8175 - 1425 SEMINOLE/S#310
CHARLOTTESVILLE, VA 22906
CONTRACT NUMBER:
MICHAEL D LOCKHART
TITLE:
UN-COOLED INFRARED IMAGING SYSTEM
TOPIC# 7 OFFICE: PM/SBIR IDENT#: 33803

THE DOD REQUIRES LOW-COST, HIGH-PERFORMANCE IR SENSORS CAPABLE OF DETECTING REDUCED OBSERVABLE IR SIGNATURES FROM MILITARY TARGETS. THE CONTRACTOR HAS UNIQUE PATENTED TECHNOLOGY FOR AN UN-COOLED IR SENSOR & IMAGING SYSTEM WITH NEAR MERCURY CADMIUM TELLURIDE (MCT) PERFORMANCE IN THE 10 MICRON REGION AT FAR LESS COST THAN MCT. THE TECHNOLOGY IS PHOTONIC, NOT THERMAL AND RELIES ON THE OPTICAL PROPERTIES OF A PHOTODICHROIC MATERIAL AFFORDING SUB-MICROSECOND RANGE RESPONSE TIMES. THE CONTRACTOR BELIEVES THIS IS THE ONLY TECHNOLOGY WHICH DIRECTLY CONVERTS AN IR SIGNAL INTO A VISIBLE ONE WITHOUT ELECTRONIC CIRCUITRY. THE IMAGING SUBSTRATE IS A CONTINUOUS THIN FILM THAT ACTS AS BOTH SENSORS AND DISPLAY. INITIAL MATERIAL STUDIES HAVE ACHIEVED AN MRT OF 0.1 DEG C OVER A 19 DEG C RANGE. THE CONTRACTOR WILL INVESTIGATE THE FEASIBILITY OF USING A PHOTODICHROIC POLYACETYLENE POLYMER ABSORBING 10 MICROMETER IR PHOTONS TO PROVIDE A LOW-COST UN-COOLED REAL-TIME IR IMAGING SYSTEM.

INFORMATION SYSTEMS LABS INC
8130 BOONE BLVD - STE 500
VIENNA, VA 22182
CONTRACT NUMBER:
JOHN E DON CARLOS
TITLE:
RELOCATABLE TARGET DETECTION AND TARGETING TECHNOLOGY
TOPIC# 17 OFFICE: PM/SBIR IDENT#: 33791

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THE CAPABILITY TO DETECT AND IDENTIFY STRATEGIC RELOCATABLE TARGETS (SRT) IS VITAL TO AN EFFECTIVE STRATEGIC COUNTER FORCE. THE CHALLENGING PROBLEM OF DOING SO IS EXACERBATED BY NATURAL CAMOUFLAGE USING FOLIAGE AND FORESTS WHERE CONVENTIONAL RADAR AND IMAGING TECHNIQUES EXPERIENCE SEVERE PROPAGATION-LOSSES AND CLUTTER CONFUSION. TO OVERCOME THIS DIFFICULT PROBLEM ISL PROPOSES THE USE OF LONGER WAVELENGTHS (1-80 m) WHERE FOLIAGE PENETRATION PROPERTIES ARE IMPROVED. SINCE TARGET IMAGING AT THESE FREQUENCIES IS DUBIOUS, WE PROPOSE TO INVESTIGATE THE FEASIBILITY OF USING WIDEBAND MEASUREMENT OF CROSS SECTIONS AS A KEY TO IDENTIFICATION OF A SPECIFIC SET OF MISSILE LAUNCHERS. SYNTHETIC APERTURE TECHNIQUES AND WIDEBAND WAVEFORMS ARE PROPOSED TO REDUCE THE RADAR RESOLUTION CELL SIZE FOR CLUTTER REJECTION. THE ISL CONCEPT CAN BE DEPLOYED WITH LEAD BOMBERS, PERHAPS SUPPLEMENTED WITH RPV'S, WITH THE RESONANT TARGET RADAR IN A MONOSTATIC OR BISTATIC MODE.

JAMAR TECHNOLOGY CO
3956 SORRENTO VALLEY BLVD - STE D
SAN DIEGO, CA 92121
CONTRACT NUMBER:
DR JAMES H MORRIS

TITLE:

UNDERWATER COMMUNICATIONS CONCEPTS ANALYSIS FOR BLUE LASER SYSTEM
TOPIC# 40 OFFICE: PM/SBIR IDENT#: 33793

IT IS PROPOSED TO CARRY OUT AN ANALYSIS OF UNDERWATER COMMUNICATION CONCEPTS BASED ON BLUE LASER TECHNOLOGY. THE LASER TRANSMITTER WILL BE A Pb-VAPOR RAMAN-SHIFTED XeCl LASER WITH AN OUTPUT OF 459 nm CORRESPONDING TO THE Cs ATOMIC RESONANCE RECEIVER. CONCEPTS TO BE ANALYZED WILL INCLUDE FIBER OPTIC BUNDLES FROM SURFACE CRAFT AND LASER TRANSMITTERS MOUNTED IN REMOTELY-PILOTED SUBMERSIBLE VEHICLES. FACTORS TO BE CONSIDERED INCLUDE SIZE, WEIGHT AND POWER CONSTRAINTS, SINGLE-TO-NOISE ADVANTAGE OVER OTHER OPTICAL COMMUNICATION CONCEPTS (ELG, SLC AND TALC), OPTICAL FIBER PROPERTIES FOR BLUE LIGHT, FIBER OPTICAL DAMAGE THRESHOLD, ETC. AN OPTIMUM CONCEPT WILL BE RECOMMENDED FOR LABORATORY DEMONSTRATION IN PHASE II WITH THE OBJECTIVES OF ACHIEVING IMPROVED RANGE, DATA RATE, SECURITY, RELIABILITY, MAINTAINABILITY, ETC.

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JAMIESON SCIENCE & ENGINEERING INC
7315 WISCONSIN AVE - STE 549W
BETHESDA, MD 20814
CONTRACT NUMBER:
ROYSTON F JACKSON
TITLE:
A HIGH RESOLUTION SENSOR FOR RPV OPERATIONS
TOPIC# 20 OFFICE: PM/SBIR IDENT#: 33799

REMOTELY PILOTED VEHICLES OFFER A WIDE VARIETY OF CAPABILITIES RANGING FROM TACTICAL AND STRATEGIC MISSIONS TO NATIONAL RECONNAISSANCE. ALL THESE MISSIONS SHARE A COMMON NEED, THAT OF HAVING A SENSOR SYSTEM THAT CAN DETECT TARGETS THAT ARE DIM DUE EITHER TO THE "FOG OF WAR" OR TO DELIBERATE ATTEMPTS OF CONCEALMENT. THERE IS ALSO A GROWING NEED TO ACHIEVE LOW OBSERVABILITY FROM A SURVIVABILITY AS WELL AS COVERTNESS VIEWPOINT. THE SPATIAL SPECTRAL INTERFEROMETER (SSI) SENSOR OFFERS A SOLUTION TO THIS PROBLEM. THE SSI IS A HIGH SPATIAL RESOLUTION, PASSIVE INFRARED SENSOR OF RELATIVELY LIGHT WEIGHT AND REQUIRES LESS DATA LINK CHANNELS AND HOTEL SERVICES. WHERE TARGET DETECTIVITY IS LIMITED BY CLUTTER, THIS SENSOR MAY HAVE ON THE ORDER OF 100 TIMES GREATER SIGNAL TO CLUTTER RATIOS. THUS, THE RPV ASSOCIATED MISSIONS, PARTICULARLY SEARCHING FROM RELOCATABLE TARGETS AND OTHER MOBILE SYSTEMS APPEARS TO BE POSSIBLE WITH THIS SENSOR. LOW OBSERVABILITY CAN BE MAINTAINED DURING DATA TRANSMISSION WHEN THE SENSOR SUITE AND OTHER ONBOARD REPORTING SYSTEMS ARE COUPLED TO A LASER RETROREFLECTOR, BIDIRECTIONAL COMMUNICATIONS LINK. THE OBJECTIVE OF THIS STUDY IS TO MAKE A PRELIMINARY EVALUATION OF THE PERFORMANCE OF THIS SENSOR AND COMMUNICATIONS LINK CONCEPT.

JSM ASSOCS
999 GREEN ST - #2603
SAN FRANCISCO, CA 94133
CONTRACT NUMBER:
DR JOSEPH L MASI
TITLE:
PASSIVE IFF SYSTEM
TOPIC# 7 OFFICE: PM/SBIR IDENT#: 33843

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THIS PROGRAM IS DESIGNED TO PROVE THE FEASIBILITY OF A PASSIVE IFF TECHNIQUE THAT IS NOT USED BY CONVENTIONAL SENSORS. BROADLY, THE PROGRAM IS MAINLY EXPERIMENTAL WHERE WE WILL INVESTIGATE THE CHARACTERISTICS OF NEW SENSORS AND SELECT THOSE SUITABLE FOR FIELD EXPERIMENTS. WE WILL VISIT A MILITARY FACILITY TO GATHER DATA ON SEVERAL TYPES OF MILITARY CRAFT OF INTEREST TO DARPA. WE WILL THEN ANALYZE THE FIELD DATA TO DETERMINE THE CHARACTERISTICS OF EACH CRAFT AND THE MAXIMUM RANGES AT WHICH RELIABLE DATA CAN BE RECORDED. LATER, WE WILL TABULATE THE CHARACTERISTICS OF THE DATA. THESE WILL FORM THE BASES OF THE PHASE II FOLLOW-ON WHERE WE WILL AUTOMATE THE IDENTIFICATION PROCESS.

LASER POWER RESEARCH
12777 HIGH BLUFF DR
SAN DIEGO, CA 92130
CONTRACT NUMBER:
DR DOUGLAS TANIMOTO
TITLE:
ELECTRO-OPTICALLY TUNABLE MID-INFRARED SOLID STATE LASER
TOPIC# 45 OFFICE: PM/SBIR IDENT#: 33837

WITH THE INCREASING THREAT OF MULTI-SPECTRAL INFRARED SEEKERS, LASERS CAPABLE OF PRODUCING MULTIPLE TUNABLE OUTPUTS IN THE MID-INFRARED ARE DESIRABLE FOR ACTIVE COUNTERMEASURES IMPLEMENTATION. A FREQUENCY AGILE SOLID STATE LASER SYSTEM IS PROPOSED WHICH INCORPORATES NOVEL TUNING METHODS WHICH ACCOMMODATE THE PROVISION FOR SINGLE OR MULTIPLE OUTPUTS WITHIN THE TUNING RANGE. THESE INNOVATIVE TUNING TECHNIQUES ARE ACCOMPLISHED OPTICALLY AND DO NOT REQUIRE ANY ACTIVE MECHANICAL ALIGNMENT ADJUSTMENTS. THE LASER IS BASED ON THE Co:MgF(2) CRYSTAL WHICH HAS DEMONSTRATED TUNABLE OUTPUTS FROM 1.75-2.5 μ m AT ROOM TEMPERATURE. TO EXTEND THE OUTPUTS FURTHER INTO THE INFRARED, THE SYSTEM PRODUCES THE DIFFERENCE FREQUENCIES OF THE Co:MgF(2) LASER WITH ITS 1.338 μ m Nd:YAG PUMP WAVELENGTH YIELDING OUTPUTS IN THE 2.9-5.0 μ m RANGE. THE DEVICE IS THUS CAPABLE OF PROVIDING SIMULTANEOUS LASER OUTPUTS IN EVERY ATMOSPHERIC TRANSMISSION WINDOW FROM 1.7-5.0 μ m.

LASER-GENICS CORP
PO BOX 611330
SAN JOSE, CA 95161
CONTRACT NUMBER:
DR RICHARD SCHLECHT
TITLE:
DIODE PUMPED Er:YAG LASER FOR IR COUNTERMEASURES
TOPIC# 45 OFFICE: PM/SBIR IDENT#: 33884

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A SERIOUS THREAT EXISTS TO OUR ARMED FORCES FROM VARIOUS INFRARED SENSORS MOUNTED ON A VARIETY OF MILITARY PLATFORMS. THE SPECTRAL RANGES OF THE SENSORS ARE IN THE 3-5 AND 8-12 MICRON BANDS. THE PRIMARY THREAT HAS BEEN IN THE 3-5 MICRON BAND. THERE IS A CRITICAL NEED TO DEVELOP AN IR SOURCE TO COUNTER THIS THREAT. IF THE SOURCE WERE TUNABLE IT WOULD BE VIRTUALLY IMMUNE TO COUNTER-COUNTERMEASURES. THE OBJECTIVE OF OUR PROPOSED PROGRAM IS TO FURTHER DEVELOP AN EXCEPTIONALLY EFFICIENT LASER SOURCE THAT WE HAVE DEMONSTRATED. WE WILL INVESTIGATE DIODE DUMPED Er:YAG AS A LASER SOURCE AT 1.54 μ M. DURING THE COURSE OF THE PHASE II EFFORT THIS LASER SOURCE WILL BE SCALED UP TO HIGH AVERAGE POWERS AND USED AS A PUMP FOR AN OPO.

MAGNESYS

1605 WYATT DR

SANTA CLARA, CA 95054

CONTRACT NUMBER:

JUAN FERNANDEZ-de-CASTRO

TITLE:

A FAST ACCESS BUBBLE MEMORY (FAB) BY FIELD ACCESS STORAGE AND
CURRENT ACCESS INTERFACE

TOPIC# 26

OFFICE: PM/SBIR

IDENT#: 33883

THIS PROPOSAL DESCRIBES AN INNOVATIVE TECHNIQUE TO CREATE FAST ACCESS MAGNETIC BUBBLE MEMORY DEVICE (FAB). TRADITIONALLY, OPERATION OF BUBBLE DEVICES HAS BEEN LIMITED TO INPUT-OUTPUT DATA RATES OF 50-100 KBITS/EC. THE PROPOSED TECHNIQUE ACHIEVES DATA RATES BETWEEN 1 AND 10 MBITS/SEC. A FAST INPUT-OUTPUT (I/O) TRACK (GENERATOR, PROPAGATOR, AND DETECTOR) BASED ON CURRENT ACCESS TECHNOLOGY IS SUBSTITUTED FOR THE SLOWER I/O TRACK USED IN FIELD ACCESS BUBBLE DEVICES. QUESTIONS OF FEASIBILITY ARE ADDRESSED IN THIS RESEARCH, SINCE CURRENT ACCESS DEVICES HAVE NEVER BEEN FABRICATED. SEVERAL DESIGNS ARE CONSIDERED IN WHICH DIFFERENT VARIATIONS OF GENERATORS, PROPAGATORS, AND DETECTORS ARE COMBINED TO FORM I/O TRACKS. OPTICAL AND ELECTRICAL CHARACTERIZATION WILL BE USED FOR EVALUATION OF THE I/O TRACK PERFORMANCE. THE FAB TECHNOLOGY, IF SUCCESSFUL, WILL ENHANCE THE PERFORMANCE OF BUBBLE MEMORIES AND WILL MAKE THEM MORE ATTRACTIVE IN APPLICATIONS WHERE FASTER DATA RATES AND SMALLER ACCESS TIMES ARE REQUIRED.

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MARK RESOURCES INC
2665 - 30TH ST/STE 200
SANTA MONICA, CA 90405
CONTRACT NUMBER:
AUGUST W RIHACZEK
TITLE:
MOVING-TARGET DETECTION AND TRACKING TECHNOLOGY
TOPIC# 24 OFFICE: PM/SBIR IDENT#: 33853

FOR THE PAST EIGHT YEARS, MARK RESOURCES HAS BEEN DEVELOPING AN EXTENSION OF RADAR RESOLUTION THEORY TO THE PROBLEM OF RESOLVING INDIVIDUAL FEATURES ON MAN-MADE TARGETS, AND WE HAVE ALSO DEVELOPED NEW SIGNAL PROCESSING METHODS TO IMPLEMENT THIS EXTENDED THEORY. THIS WORK, WHICH HAS BEEN SUPPORTED UNDER SEVERAL CONTRACTS FROM AIR FORCE WRIGHT AERONAUTICAL LABORATORY AND DARPA, HAS BEEN DIRECTED AT THE IDENTIFICATION OF GROUND VEHICLES. ONE OF THE RESULTS OF THIS EFFORT HAS BEEN THE DEVELOPMENT OF A DETECTION ALGORITHM FOR THE WEAK SCATTERERS WHICH DEFINE THE OUTLINE OF A VEHICLE. THE SAME ALGORITHM IS ALSO APPLICABLE TO THE MORE GENERAL PROBLEM OF DETECTION STEALTH AIRCRAFT. IN THE PROPOSED PROGRAM WE PLAN TO FURTHER DEVELOP AND TEST THE NEW ALGORITHM ON RADAR DATA FROM TARGETS REPRESENTATIVE OF THE STEALTH TECHNOLOGY. THE OBJECTIVE WILL BE TO DETERMINE THE IMPROVEMENT IN DETECTION PERFORMANCE COMPARED WITH CONVENTIONAL STATISTICAL DETECTION METHODS.

MARKO MATERIALS INC
144 RANGEWAY RD
NORTH BILLERICA, MA 01862
CONTRACT NUMBER:
DR RANJAN RAY
TITLE:
INNOVATIVE MULTILAYER METALLIC COATINGS ON SiC FIBERS VIA NOVEL CHEMICAL VAPOR DEPOSITION TECHNIQUES FOR TiAl MATRIX COMPOSITES
TOPIC# 37 OFFICE: PM/SBIR IDENT#: 33850

DARPA IS SEEKING RESEARCH AIMED AT ADDRESSING THIN UNIFORM COATING

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OF MULTIFILAMENT TOWS OF CERAMIC AND/OR GRAPHITE FIBERS AT ECONOMICALLY ATTRACTIVE RATES. THESE FIBERS WILL BE USED FOR COMPOSITES BASED ON CERAMICS, TITANIUM ALLOYS AND TITANIUM ALUMINIDE MATRICES. WE PROPOSE TO DEVELOP MULTILAYERED, ENGINEERED INTERFACE COATINGS FOR SiC FIBERS COMPATIBLE WITH TiAl INTERMETALLIC MATRIX. FIRST APPROPRIATE METALLIC COATINGS WILL BE IDENTIFIED WHICH WILL MAKE THE SiC FIBERS 1) CHEMICALLY COMPATIBLE, 2) MATCH ITS COEFFICIENT OF THERMAL EXPANSION WITH TiAl MATRIX, 3) IMPART HIGH INTERFACIAL BOND STRENGTH, AND 4) IMPART LOCAL DUCTILITY AT THE INTERFACE. THESE COATINGS WILL THEN BE DEPOSITED ON MULTIFILAMENT TOWS OF SiC FIBERS USING INNOVATIVE CHEMICAL VAPOR DEPOSITION (CVD) TECHNIQUES THAT HAVE THE POTENTIAL TO INCREASE DEPOSITION KINETICS AND IMPROVE COATING ECONOMICS. THESE NEW CVD TECHNIQUES COMBINE THE LOW COST OF PACK METALLIZATION WITH THE HIGH HEAT AND MASS TRANSFER OF A FLUIDIZED BED REACTOR. THE MORPHOLOGY, THICKNESS, MICROSTRUCTURE AND COMPOSITION OF THE COATINGS, AS WELL AS THE EXTENT OF DIFFUSION AND REACTION BETWEEN THE SiC FIBER AND THE COATINGS WILL BE CHARACTERIZED. WE PROPOSE TO FORM A TEAM WITH PROF. AMIT GHOSH, UNIVERSITY OF MICHIGAN, TO DESIGN MULTI-LAYERED COATINGS, AND DR. ANGEL SANJURJO, SRI INTERNATIONAL TO DEPOSIT THE COATINGS VIA CVD TECHNIQUES, TO COMPLEMENT MARKO'S EFFORT WHICH HAS PROCESSED HIGH QUALITY RAPIDLY SOLIDIFIED (MELT SPUN) TiAl POWDERS SUITABLE FOR FABRICATION OF SiC/TiAl COMPOSITES.

MARKO MATERIALS INC
144 RANGEWAY RD
NORTH BILLERICA, MA 01862
CONTRACT NUMBER:
DR RANJAN RAY
TITLE:

A NOVEL TECHNIQUE TO FABRICATE TiB(2) FIBERS DIRECTLY FROM MELT
TOPIC# 33 OFFICE: PM/SBIR IDENT#: 33854

DEVELOPMENT OF SUITABLE REINFORCEMENT FIBERS FOR HIGH TEMPERATURE COMPOSITE MATERIALS IS THE MAJOR TECHNICAL BARRIER LIMITING THE INTRODUCTION OF THESE NEW MATERIALS FOR ADVANCED AIRCRAFT ENGINES. WE PROPOSE TO FABRICATE MONOFILAMENT TiB(2) FIBERS USING A NOVEL CONCEPT. THE CHOICE OF TiB(2) FIBERS IS BASED ON ITS CHEMICAL COMPATIBILITY WITH ALUMINIDE MATRICES, HIGHER COEFFICIENTS OF THERMAL

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EXPANSION AND ELASTIC MODULUS, AND LOWER DENSITY COMPARED TO OTHER CANDIDATE REINFORCEMENT FIBERS. IN THE FIRST STEP OF THE PROPOSED NOVEL FABRICATION TECHNIQUE, WE WILL OBTAIN A B RICH Ti FILAMENT DIRECTLY FROM THE MELT USING AN ADVANCED MELT SPINNING TECHNIQUE. IN THE SECOND STEP THE B RICH Ti FILAMENT WILL BE COATED WITH LOW-COST B COATINGS USING AN INNOVATIVE CHEMICAL VAPOR DEPOSITION (CVD) PROCESS THAT COMBINES THE LOW COST OF PACK METALLIZATION WITH THE HIGH HEAT AND MASS TRANSFER OF A FLUIDIZED BED REACTOR. WE WILL CHARACTERIZE THE MECHANICAL AND MICROSTRUCTURAL PROPERTIES OF THE TiB(2) FIBERS FABRICATED USING THE ABOVE TECHNIQUE, GIVING PARTICULAR ATTENTION TO THE EXTENT OF DEGREE OF DIFFUSION AND REACTION BETWEEN THE B RICH Ti SUBSTRATE AND B COATING. THE LOW COST B COATINGS VIA CVD IN A FLUIDIZED BED REACTOR WILL BE PERFORMED IN COLLABORATION WITH DRS. ANGEL SAN JURJO AND DIGBY MACDONALD OF SRI INTERNATIONAL, MENLO PARK, CA.

MATERIALS & ELECTROCHEMICAL RSCH CORP

7960 S KOLB RD
TUCSON, AZ 85706

CONTRACT NUMBER:

PRAKASH ARYA

TITLE:

A PLASMA ASSIST CVD PROCESS FOR PRODUCING TiB(2) AND OTHER CERAMI
MULTIFILAMENT TOWS

TOPIC# 33 OFFICE: PM/SBIR IDENT#: 33826

THERE IS A VERY LARGE PENT-UP DEMAND FOR ADVANCED HIGH PERFORMANCE HIGH TEMPERATURE INTERMETALLIC COMPOSITES WHICH IS LIMITED BY THE AVAILABILITY OF AN ECONOMICAL SMALL DIAMETER CERAMIC FIBER WITH GOOD STRENGTH RETENTION > OR - 1400 DEG C. COMMERCIALY AVAILABLE CERAMIC FIBERS PRODUCED AS MONOFILAMENT BY CVD OR PYROLYSIS OF POLYMER PRE-CURSOR HAVE ONE OR MORE FAULTS OF POOR STRENGTH RETENTION ABOVE 800 DEG C, LOW MODULUS, LARGE DIAMETER AND ARE QUITE EXPENSIVE. PLASMA ASSIST CVD OFFERS THE POTENTIAL OF DEPOSITING VERY FINE GRAIN DEPOSITS ON MULTIFILAMENT SMALL DIAMETER SUBSTRATE PRODUCING FIBERS IN THE SIZE RANGE OF 10-50 MICRONS WHICH SHOULD HAVE THERMAL STABILITY OF 1400 DEG C. A STATISTICAL EXPERIMENTAL PROGRAM IS PROPOSED FOR DEVELOPING ECONOMICAL THERMALLY STABLE MULTIFILAMENT TiB(2), TiB AND TiC CERAMIC FIBERS UTILIZING PLASMA ASSIST CVD.

SUBMITTED BY

MATERIALS TECHNOLOGIES CORP

57 MARYANNE DR

MONROE, CT 06468

CONTRACT NUMBER:

DR YOGESH MEHROTRA

TITLE:

MoSi₂/SiC FIBER REINFORCED COMPOSITES FOR HIGH PERFORMANCE
STRUCTURAL APPLICATIONS

TOPIC# 37 OFFICE: PM/SBIR IDENT#: 33823

THE MAIN OBJECTIVE OF THIS PROPOSED PROGRAM IS TO DEVELOP THE TECHNOLOGY FOR FABRICATING HIGH TEMPERATURE, HIGH OXIDATION RESISTANTS MoSi₂/SiC FIBER REINFORCED CERAMIC STRUCTURES VIA A SCALABLE AND COST EFFECTIVE CHEMICAL VAPOR DEPOSITION (CVD) + HOT ISOSTATIC-PRESSING PROCESSES. IN PHASE I, THE FEASIBILITY OF FABRICATING A HIGH PERFORMANCE MoSi₂/SiC COMPOSITE VIA A SCALABLE CVD PROCESS WILL BE ESTABLISHED. SMALL SAMPLES OF THE COMPOSITE WILL BE FABRICATED BY COATING SiC FIBERS BY CVD AND THEN HIP'ING THE FIBERS IN MoSiC MATRIX SUCH THAT LARGE COMPRESSIVE STRESSES ARE PRODUCED ON THE COMPOSITE SURFACE. THE COMPOSITE MATERIAL WILL BE CHARACTERIZED FOR IMPORTANT PROPERTIES SUCH AS DENSITY HARDNESS, FLEXURAL STRENGTH, FRACTURE TOUGHNESS AND THERMAL EXPANSION COEFFICIENT. FINALLY, ANALYTICAL UNDERSTANDING OF THE COMPOSITE AND THE CVD + HIP PROCESS PARAMETERS WILL BE DEVELOPED TO PROVIDE PROCESS SCALING TO LARGE SIZES AND TO OTHER MATERIALS.

MCS CORP

1401 WILSON BLVD

ARLINGTON, VA 22209

CONTRACT NUMBER:

ROBERT J EIN

TITLE:

HIGH POWER ACTIVE ACOUSTIC CANCELLATION

TOPIC# 10 OFFICE: PM/SBIR IDENT#: 33819

NOISE IN ARMY WEAPONS SYSTEMS, SUCH AS TRACKED ARMORED VEHICLES,

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INCREASES DETECTABILITY OF OUR FORCES, REDUCES EFFECTIVENESS BY REQUIRING CUT BACK OR SHUT DOWN OF EQUIPMENT TO REDUCE NOISE, REDUCES OR ELIMINATES THE PROSPECT OF COVERT OPERATION AND REDUCES CREW EFFECTIVENESS IN AREAS OF HIGH NOISE LEVELS. ADDITIONAL REDUCTIONS IN NOISE ARE REQUIRED OVER WHAT CONVENTIONAL METHODS OF NOISE REDUCTION ARE PROVIDING. ACTIVE NOISE AND VIBRATION CANCELLATION HAVE THE POTENTIAL TO REDUCE BOTH PRIMARY AND SECONDARY ACOUSTIC EMISSIONS TO LEVELS BELOW THE THRESHOLDS OF SOUND RANGING AND DETECTION EQUIPMENT IN USE TODAY. THIS PROJECT WILL ACCURATELY SURVEY AND MAP SOUND INTENSITY LEVELS OF A TYPICAL COMBAT VEHICLE. THIS MAPPING WILL IDENTIFY AND CHARACTERIZE SOUND SOURCES, LEVEL AND SPECTRAL CHARACTERISTICS. THESE SOURCE WILL BE CATALOGUED AND EVALUATED FOR CORRECTIVE ACTION. AN ELECTRONIC MUFFLER WILL BE DESIGNED, INSTALLED AND TESTED ON THE BRADLEY FIGHTING VEHICLE DIESEL ENGINE EXHAUST. THE PURPOSE OF THIS SYSTEM IS TO REDUCE EXHAUST NOISE WITHOUT ADDING BACK PRESSURE ON THE ENGINE. NOISE REDUCTIONS FROM 10 dB TO 25 dB HAVE BEEN EXPERIENCED ON GASOLINE AND DIESEL ENGINE EXHAUST WITH THE ELECTRONIC MUFFLER.

MEI RESEARCH
PO BOX 6052
FREMONT, CA 94538
CONTRACT NUMBER:
JUZER S MOGRI
TITLE:

TESTING AND PACKAGING TECHNOLOGY FOR MULTI-GIGAHERTZ BANDWIDTH
HIGH PINOUT DENSITY DIGITAL CIRCUITS
TOPIC# 28 OFFICE: PM/SBIR IDENT#: 33809

THIS PROPOSAL ADDRESSES THE NEED FOR DEVELOPING SUITABLE AND INNOVATIVE TECHNIQUES FOR TESTING AND PACKAGING OF MULTI-GIGAHERTZ BANDWIDTH ICs WITH HIGH PINOUT DENSITY. THE FIRST SECTION ADDRESSES THE CRITICALITY OF THE TESTING PROBLEM AND OBSERVES THAT THE TECHNOLOGY TO SOLVE THIS PROBLEM SATISFACTORILY IS CURRENTLY AVAILABLE, BUT NEEDS TO BE HARNESSSED. THE NEXT SECTION ENUMERATES THE SPECIFIC TECHNICAL OBJECTIVES FOR THIS PROJECT. THE FOLLOWING SECTION COMPRISES FOUR SUBSECTIONS: (i) TESTER DESIGN GOALS (ii) TWO PROMISING DESIGN APPROACHES, (iii) FOUR CRITICAL AREAS THAT NEED ADVANCEMENTS IN THE STATE-OF-THE-ART, AND, (iv) A SPECIFIC LIST OF

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TASKS TO BE PERFORMED DURING PHASE I. THE NEXT AND FINAL TECHNICAL SECTION COVERS BRIEFLY RELATED WORK IN THIS FIELD. WHILE MOST OF THE PROPOSAL DEALS WITH TESTING TECHNIQUES, A NOVEL IDEA FOR ULTRA-HIGH DENSITY PACKAGING AND 'IMPEDANCE TRANSPARENT DESIGN' IS PRESENTED. A NOVEL DESIGN APPROACH FOR A TESTER FRONT END CAPABLE OF GENERATING 256KBITS LENGTH TEST VECTORS AND STORING AN EQUALLY LONG RESULT IS GIVEN, AND A FEASIBLE TECHNIQUE FOR IMPLEMENTING A MODULAR TESTER ARCHITECTURE IS PRESENTED.

MODELL DEVELOPMENT CORP

39 LORING DR

FRAMINGHAM, MA 01701

CONTRACT NUMBER:

MICHAEL MODELL

TITLE:

DESTRUCTION OF RETIRED CHEMICAL WEAPONS BY SUPERCRITICAL WATER OXIDATION

TOPIC# 30

OFFICE: PM/SBIR

IDENT#: 33834

THIS PROPOSAL DESCRIBES AN SBIR PROJECT TO EVALUATE A NEW APPROACH TO DEMILITARIZATION OF RETIRED CHEMICAL WEAPONS USING SUPERCRITICAL WATER OXIDATION (SCWO). THIS NEW TECHNOLOGY HAS BEEN SHOWN TO EFFECTIVELY DESTROY TOXIC AND HAZARDOUS WASTES. THE OXIDATION IS CONDUCTED IN A CLOSED SYSTEM WHICH VIRTUALLY ELIMINATES POLLUTANT EMISSION TO THE ENVIRONMENT. THE EFFLUENTS OF CHEMICAL AGENT DESTRUCTION ARE ANTICIPATED TO BE NON-HAZARDOUS, AND READILY DISPOSED. THE PRIMARY GOAL OF THE PROPOSED PROJECT IS TO DEMONSTRATE THAT SCWO CAN PROVIDE DESTRUCTION EFFICIENCIES OF AT LEAST 99.9999% AND POSSIBLY 99.999999% FOR CHEMICALS WITH STRUCTURES SIMILAR TO GB, VX AND HD. ADDITIONAL OBJECTIVES ARE TO DEVELOP A FULL SCALE DESIGN, AND TO PROVIDE PRELIMINARY ECONOMIC ESTIMATES.

MSNW INC

PO BOX 865

SAN MARCOS, CA 92069

CONTRACT NUMBER:

DR GEORGE H REYNOLDS

TITLE:

Y(2)O(3) AND Y(2)O(3)-BASED COATINGS FOR FIBERS AND PARTICULATES

TOPIC# 37

OFFICE: PM/SBIR

IDENT#: 33845

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THE PROPOSED PHASE I RESEARCH PROJECT WILL EXAMINE ALTERNATIVE METHODS FOR SYNTHESIS OF $Y(2)O(3)$ AND $Y(2)O(3)$ -BASED COATINGS ON CERAMIC FIBERS AND METALLIC PARTICLES FOR USE IN CERAMIC AND INTERMETALLIC BRITTLE MATRIX COMPOSITES. SYNTHESIS METHODS AND HEAT TREATMENT CONDITIONS WILL BE VARIED TO PRODUCE THERMOCHEMICALLY COMPATIBLE COATINGS HAVING A RANGE OF INTERFACIAL SHEAR STRENGTHS FROM NEAR-ZERO TO NEAR THEORETICAL. PROTOTYPE COATED FIBERS AND PARTICULATES WILL BE EVALUATED AS CONSTITUENT PHASES IN BOTH CERAMIC AND INTERMETALLIC MATRIX COMPOSITE SYSTEMS.

MTL SYSTEMS INC
3481 DAYTON-XENIA RD
DAYTON, OH 45431
CONTRACT NUMBER:
DAVID KELCH
TITLE:
SRT SPECTRAL SIGNATURE ANALYSIS
TOPIC# 17 OFFICE: PM/SBIR IDENT#: 33878

IN RESPONSE TO THE THREAT OF ROAD-MOBILE AND RAIL-MOBILE INTERCONTINENTAL BALLISTIC MISSILES, IT IS IMPERATIVE THAT THE UNITED STATES HAVE THE CAPABILITY OF DETECTING AND IDENTIFYING THESE ELUSIVE TARGETS. MULTISPECTRAL SIGNATURE DETECTION IS A TOOL THAT CAN BE USED AS A FRONT END FILTER FOR OTHER SENSORS. MTL HAS BEEN USING A 63 CHANNEL MULTISPECTRAL IMAGING SPECTRORADIOMETER FOR COLLECTING DATA ON TARGETS AND BACKGROUNDS. THIS DATA HAS BEEN ANALYZED AND PROCESSED THROUGH TRANSFORMATIONS THAT HAVE DISCRIMINATED BETWEEN CAMOUFLAGE THAT WAS DEPLOYED IN THE AREA AND THE BACKGROUND. THIS TECHNOLOGY HAS GREAT POTENTIAL FOR DEVELOPING A FLIGHT DEPLOYABLE, REAL TIME CAMOUFLAGE DETECTOR. THE OBJECTIVE OF THIS PROJECT IS TO VERIFY THE FEASIBILITY OF DETECTING CAMOUFLAGE, AND OTHER MATERIALS ASSOCIATED WITH STRATEGIC RELOCATABLE TARGETS, WITH A MULTISPECTRAL (OR HYPERSPECTRAL) SENSOR.

MULTIMAX INC
6006 GREENBELT RD -- STE 271
GREENBELT, MD 20770
CONTRACT NUMBER:
DR LOUIS CHU
TITLE:
DETERMINATION OF GEOLOGIC FEATURES OF THE NEVADA TEST SITE BY ANALYSIS OF LANDSAT AND SPOT DATA
TOPIC# 2 OFFICE: PM/SBIR IDENT#: 33818

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THE USE OF MULTI-SPECTRAL SPACE IMAGERY HAS BECOME A VERY POWERFUL MEAN TO PROVIDE GEOLOGICAL PARAMETERS PERTAINING TO ROCK MINEROLOGY, FAULT LIEAMENTS, AND STRUCTURAL CONTACTS ETC, FOR A GIVEN REGION. THESE INFORMATION ARE VERY USEFUL IN COMPLEMENTING DATA OBTAINED THROUGH CONVENTIONAL FIELD MAPPING. ENHANCEMENT OF THE MULTI-SPECTRAL SPACE IMAGERY WILL ALSO ALLOW DIRECT VISUAL INTERPRETATION OF CHARACTERISTIC SURFACE FEATURES ASSOCIATED WITH NUCLEAR EXPLOSIONS. THIS STUDY WILL UTILIZE MODERN IMAGE PROCESSING TECHNIQUES TO ANALYZE LANDSAT-4 THERMATIC MAPPER (TM) AND SYSTEM PROBATOIRE D'OBSERVATION DE LA TERRA (SPOT) DATA IN ORDER TO DETECT, DELINEATE, MAP AND IDENTIFY REGIONAL SURFICIAL FEATURES AND PATTERNS. A NEWLY DEVELOPED DIRECT BAND RATIOING METHOD WILL BE APPLIED TO THE TM AND SPOT DATA SYNERGISTICALLY. THIS METHOD WILL ENHANCE CHROMATIC VARIATION IN MULTI-SPECTRAL COLOR IMAGERY WHILE PRESERVING MOST TOPOGRAPHIC EXPRESSION AND ALBEDO INFORMATION. THE NEVADA TEST SITE WILL BE USED AS A CASE STUDY IN AN ATTEMPT TO CORRELATED THE MAPPED FAULTS AND ROCK MINERALOGY FROM GROUND OBSERVATIONS WITH THOSE OBTAINED IN THIS STUDY. BY PROCESSING THE MULTI-SPECTRAL SPACE PHOTOGRAPHY BEFORE AND AFTER AN EXPLOSION, WE WILL BE ABLE TO IDENTIFY THE TYPES OF LOCAL GEOLOGICAL DISTURBANCE THROUGH CHARACTERISTIC CHANGES IN THE ROCK MINERALOGY, ACTIVATION OF LOCAL FAULTS AND/OR OFFSETS OF STRUCTURAL CONTACTS.

NUMERICAL TECHNOLOGY INC
4836 FAIRWAY RIDGE S
WEST BLOOMFIELD, MI 48033
CONTRACT NUMBER:
ANTHONY LEE

TITLE:
ASSESSMENT TO COUNTERMEASURE MATERIALS BY COMBAT MODELING
TOPIC# 34 OFFICE: PM/SBIR IDENT#: 33882

THE PROPOSED PHASE I EFFORT WILL EXAMINE AND REVIEW EXISTING COMBAT MODELS AND SELECT ONE BASE MODEL. THE CODE WILL THEN BE MODIFIED INTO A NEW MODEL FOR A SPECIFIC COUNTERMEASURE (CM) MATERIAL OR SYSTEM FOR A MAJOR WEAPON SYSTEM SUCH THAT THE APPROACH OF USING COMBAT MODELING TO EVALUATE CM SYSTEMS CAN BE DEMONSTRATED.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505
CONTRACT NUMBER:
DR TOMASZ JANNSON

TITLE:
SPATIAL COHERENCE DISCRIMINATION FILTERS
TOPIC# 17 OFFICE: PM/SBIR IDENT#: 33881

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IN A RECENT PUBLICATION J. JANNSON, T. JANNSON AND E. WOLF SHOWED THE THEORETICAL POSSIBILITY OF FABRICATING STRUCTURES THAT COULD HAVE MARKEDLY DIFFERENT DIFFRACTION EFFICIENCIES (REFLECTIVITIES) AS A FUNCTION OF THE SPATIAL COHERENCE OF THE INCOMING RADIATION. THUS, IN PRINCIPLE, IT SHOULD BE POSSIBLE TO FIND STRUCTURES THAT COULD HAVE HIGH REFLECTIVITY TO LASER BEAMS BUT LOW REFLECTIVITY (I.E. HIGH TRANSMISSION) FOR AMBIENT RADIATION. THIS PROJECT SEEKS TO IDENTIFY THOSE ARCHITECTURES WHICH CAN SHOW THE LARGEST DISCRIMINATION AND FABRICATE PROOF-OF-PRINCIPLE FILTERS. BOTH PASSIVE AND ACTIVE DIFFRACTION STRUCTURES WILL BE CONSIDERED. OPTICAL CHARACTERISTICS SUCH AS PHOTOPIC EFFICIENCY, OPTICAL DENSITY AT THE THREAT WAVELENGTHS AND RESPONSE TIMES ARE CONSIDERED PARTICULARLY IMPORTANT PARAMETERS. QUESTIONS SUCH AS POSSIBLE BAND WIDTH OF SUCH STRUCTURES, THE ABILITY TO FABRICATE THESE FILTERS IN THE IR AS WELL AS VISIBLE REGION OF THE SPECTRUM WILL ALSO BE INVESTIGATED. THE END GOAL IS AN EFFECTIVE ECONOMIC FILTER AGAINST WAVELENGTH AGILE LASER THREATS.

PLASMATRON INC
504 IRONWOOD WY
DRESHER, PA 19025

CONTRACT NUMBER:
DR KAMBIZ POURREZAEI

TITLE:

FABRICATION OF HIGH-STRENGTH SUPERCONDUCTING WIRES AND TAPES
TOPIC# 32 OFFICE: PM/SBIR IDENT#: 33872

FABRICATION OF A MULTI-LAYER SUPERCONDUCTING COMPOSITE STRUCTURE ON A HIGH-STRENGTH SUBSTRATE SUCH AS NICKEL-ALLOY OR STEEL IS PROPOSED. THE COMPOSITE LAYERS CONSIST OF A BARRIER LAYER, A SUPERCONDUCTING LAYER, A PROXIMITY LAYER, AND A PROTECTIVE LAYER. PROVISION IS MADE FOR POSSIBLE USE OF MORE THAN ONE LAYER OF SUPERCONDUCTING MATERIAL. THE SUPERCONDUCTING LAYER (ELG. Y-Ba-Cu-O) MAY BE MIXED WITH SILVER AND ALSO PERHAPS FACED ON BOTH SIDES WITH SILVER LAYERS. THE PRESENCE OF SILVER IS EXPECTED TO IMPROVE THE CONDUCTIVITY WITH NO ADVERSE EFFECT DUE TO HIGH-TEMPERATURE CHEMICAL REACTIONS. TWO CONFIGURATIONS ARE PROPOSED, NAMELY, A TAPE CONFIGURATION AND A WIRE CONFIGURATION. IN THE TAPE CONFIGURATION, A HIGH-STRENGTH TAPE OF

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NICKEL ALLOY OR STEEL IS USED AND IN THE WIRE CONFIGURATION A NICKEL ALLOY OR STEEL FILAMENT IS USED. ONE SIGNIFICANT ADVANTAGE OF THE TAPE CONFIGURATION IS THAT THE SUPERCONDUCTING COMPOSITE LAYERS CAN BE FORMED ON A SILVER FOIL AND THEN AFTER HIGH-TEMPERATURE ANNEALING BE LAMINATED TO THE HIGH-STRENGTH SUBSTRATE. THIS PROCESS WILL ELIMINATE THE HIGH-TEMPERATURE CHEMICAL REACTION BETWEEN THE SUBSTRATE AND THE COMPOSITE STRUCTURE. IN THE TAPE TECHNOLOGY, TAPE CASTING IS PROPOSED FOR FABRICATION OF THE SUPERCONDUCTING LAYER. IN THE WIRE TECHNOLOGY, UTILIZATION OF BOTH CONVENTIONAL CERAMIC TECHNOLOGY AND THIN FILM TECHNOLOGY (SPUTTERING) IS PROPOSED. THIN FILM TECHNOLOGY (E.G. EVAPORATION OR SPUTTERING) WILL BE USED FOR DEPOSITION OF THE PROXIMITY LAYER IN BOTH THE TAPE AND WIRE TECHNOLOGIES.

POLYTRONIX INC
805 ALPHA DR
RICHARDSON, TX 75081
CONTRACT NUMBER:
DR B -G Wu

TITLE:

NOVEL METHODS FOR PROTECTION OF PERSONNEL AGAINST LASERS
TOPIC# 47 OFFICE: PM/SBIR IDENT#: 33839

WE PROPOSE TO DEVELOP A NEW LIGHT SHUTTER APPROACH TO PROVIDE OCULAR PROTECTION FOR PERSONNEL AGAINST LASER RADIATION. THE LIGHT SHUTTER INVOLVES THE APPLICATION OF A REVERSE PHASE MODE POLYMER DISPERSED LIQUID CRYSTAL (PDLC) WHICH HAS BEEN DEVELOPED IN OUR LABORATORIES. THE REVERSE PHASE MODE PDLC SYSTEM PROVIDES LC ALIGNMENT AND THUS GOOD OPTICAL TRANSMISSION IN THE ABSENCE OF ANY APPLIED FIELDS. THIS OPTICAL ALIGNMENT HAS BEEN OBTAINED USING A PROPRIETARY APPROACH DEVELOPED BY POLYTRONIX, INC. IMPINGEMENT OF LASER RADIATION ON THIS REVERSE PHASE PDLC MATERIAL CONVERTS IT FROM A TRANSMISSIVE TO A SCATTERING (DISPERSIVE) MODE. THE LIGHT SHUTTER LENS DEVELOPED ON THIS PRINCIPLE WILL OPERATE WITHOUT NEED FOR AN APPLIED VOLTAGE OR ANY PHOTODETECTOR SWITCHES. THE ADVANTAGES OF OUR PROPOSED TECHNOLOGY VIS-A-VIS OTHER CURRENT APPROACHES TO LIGHT SHUTTER PROTECTIVE DEVICES ARE DISCUSSED IN THIS PROPOSAL. THE PHASE I WORK EFFORT WILL FOCUS ON IMPROVING THE OPTICAL TRANSMISSION CHARACTERISTICS OF THE REVERSE PHASE MODE PDLC ALIGNMENT AND WILL ALSO INVOLVE DETAILED

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MEASUREMENTS OF THE RESPONSE TIME OF THIS SHUTTER AT VARIOUS
INCIDENT LASER WAVELENGTHS AND POWER DENSITIES. A COMPLETE, FULLY
OPERATIONAL LIGHT SHUTTER WOULD CULMINATE THE PHASE I EFFORT.

POTOMAC SYNERGETICS INC (PSI)
PO BOX 953
McLEAN, VA 22101
CONTRACT NUMBER:
V J CORCORAN
TITLE:
OCULAR PROTECTION AGAINST BATTLEFIELD LASERS
TOPIC# 47 OFFICE: PM/SBIR IDENT#: 33833

POTOMAC SYNERGETICS,, INC. (PSI), A WOMAN-OWNED, SMALL BUSINESS,
PROPOSES TO ANALYZE VARIOUS APPROACHES AND IDENTIFY THE MOST
PROMISING APPROACH FOR PROTECTING PERSONNEL AGAINST BATTLEFIELD
LASERS. PSI PROPOSES TO RESTRICT ITS STUDY TO LIQUID CRYSTALS AND
POLYMERS FOR REASONS GIVEN IN THE TEXT. THESE MATERIALS ARE THE
ONLY ONES THAT OFFER A REALISTIC HOPE OF PROVIDING PERSONNEL WITH
SOMETHING RESEMBLING EYEGLASSES THAT WILL PROTECT PERSONNEL FOR
LASER RADIATION. THE APPROACH TAKEN ON THIS PROGRAM IS AN EXTENSION
OF THE WORK DONE ON TWO SBIR CONTRACTS, PASSIVE PROTECTION OF OPTICAL
SENSORS (PAPOOSE) AND PAPOOSE II FOR THE U.S. ARMY LETTERMAN RESEARCH
INSTITUTE. SINCE THE TIME OF THE PAPOOSE CONTRACT, IMPROVEMENTS IN
MATERIALS HAVE BEEN MADE TO THE POINT WHERE IT IS NOW REASONABLE TO
THINK OF EYE PROTECTION DEVICES THAT RESEMBLE EYEGLASSES. ON PAPOOSE
II, WHICH IS CURRENTLY IN PROGRESS, THIN-FILM POLYMERS HAVE BEEN
OBTAINED AND ARE IN THE PROCESS OF BEING TESTED. IF THESE MATERIALS
CAN DEMONSTRATE TO OD THAT THE DARPA REQUIRES, THE PROTECTIVE
DEVICES RESEMBLING EYEGLASSES COULD BE FABRICATED. THE FEATURES OF
THE PAPOOSE ARE: PASSIVE (NO POWER REQUIRED); NEGLIGIBLE INSERTION
LOSS; REFLECTANCE IS POWER DEPENDENT; RELIABLE AND MAINTAINABLE;
AUTOMATICALLY ACTIVATED (NO SENSOR REQUIRED); WAVELENGTH INDEPENDENT
THROUGHOUT THE RANGE OF INTEREST; FAST RISE TIME (1 ns); LARGE
ACCEPTANCE ANGLE; LOW COST, AND VIRTUALLY UNLIMITED APERTURE.

PRISMOID OPTICAL
RT 2 - PO BOX 287
MAPLE LAKE, MN 44358
CONTRACT NUMBER:
RICHARD VIZENOR
TITLE:
INTUITIVE COCKPIT DISPLAYS FOR FIGHTER AIRCRAFT
TOPIC# 18 OFFICE: PM/SBIR IDENT#: 39431

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THIS DISPLAY TECHNIQUE USES A SERIES OF ACCURATELY PLACED PARTIALLY REFLECTING MIRRORS (RESEMBLING CURVED LOUVERS) WITHIN THE VISOR THICKNESS IN AN AREA THE DISPLAY IS DESIRED TO BE OBSERVED. THE DISPLAY CAN BE PLACED AT ALMOST ANY POSITION AROUND THE HELMET EDGE. THE OPTICAL CHARACTERISTICS OF THE LOUVERS ALLOW THE DISPLAY TO BE DIRECTED TOWARD THE EYE. THE ABILITY TO BE ABLE TO DESIGN A LOUVER MIRROR "FIELD" FOR A PARTICULAR DISPLAY (IRREGARDLESS OF ITS POSITION AROUND THE HELMET EDGE) NOW ALLOWS THESE FIELDS OF VIEW TO BE CONNECTED IN SERIES TO GIVE COMPLETE PANORAMIC VIEWS OF DISJOINTED DISPLAYS.

PROCESSING RESEARCH INC
8027 LEESBURG PIKE - STE 201
VIENNA, VA 22182
CONTRACT NUMBER:
DUDLEY C EDGEMON
TITLE:
DEVELOPMENT OF PHASE MEASUREMENTS AND ENHANCED SIGNAL PROCESSING
FOR MINE DETECTION
TOPIC# 11 OFFICE: PM/SBIR IDENT#: 33797

THE PROPOSED EFFORT WILL DEMONSTRATE THE FEASIBILITY OF A UNIQUE TECHNIQUE FOR DETECTION OF BOTH METALLIC AND NON-METALLIC MINES. THIS DETECTOR IS READILY INTEGRATABLE INTO A "HUNTER/KILLER" COUNTERMINE SYSTEM. THE TECHNIQUE IS BASED ON A PROPRIETARY PHASE MEASUREMENT TECHNIQUE AND ENHANCED SIGNAL PROCESSING ALGORITHMS. PHASE MEASUREMENT TECHNIQUES HAVE BEEN DEMONSTRATED TO BE BENEFICIAL IN THE DETECTION OF NON-METALLIC BURIED OBJECTS. THE PHASE MEASUREMENT DEVICE CAN BE IMPLEMENTED IN A SINGLE MONOLITHIC CHIP WHICH MINIMIZES THE COST OF THE HARDWARE PLACED AT RISK AND PERMITS OPERATION AT A SAFE STANDOFF DISTANCE.

PROCESSING RESEARCH INC
8027 LEESBURG PIKE - STE 201
VIENNA, VA 22182
CONTRACT NUMBER:
DR VERNE G NOMADY
TITLE:
A MONOLITHIC ACT CHANNELIZED INTERCEPT SYSTEM
TOPIC# 8 OFFICE: PM/SBIR IDENT#: 33798

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CURRENT "ALL DIGITAL" CHANNELIZED APPROACHES TO INTERCEPT OF SPREAD SPECTRUM/FREQUENCY HOPPING COMMUNICATIONS SIGNALS CANNOT EFFECTIVELY ADDRESS THE PROBLEMS POSTED BY "FULL BAND: ("200 MHz) MEDIUM-FAST (> OR - 500 HPS) FREQUENCY HOPPING WAVEFORMS. HYBRID DS/FH COMMUNICATIONS WAVEFORMS POSE EVEN MORE STRINGENT PERFORMANCE REQUIREMENTS, UNSATISFIABLE BY CURRENT OR NEAR-TERM DIGITAL TECHNOLOGY. USE OF ACT TECHNOLOGY AS A DIGITALLY PROGRAMMABLE TRANSVERSAL CHANNELIZER, OPTIMIZED ALTERNATIVELY FOR EITHER "SPREAD" (HYBRID) OR "UNSPREAD" FREQUENCY HOPPING WAVEFORMS CAN PROVIDE THE ESSENTIAL FRONT END FREQUENCY PARTITIONING FUNCTION FOR A HIGH PERFORMANCE SPREAD SPECTRUM/LPI COMMUNICATIONS INTERCEPT SYSTEM. ARRANGING TWO SUCH CHANNELIZERS AS AN INTERFEROMETER WILL ALLOW EXPLOITATION OF THE ONE ATTRIBUTE WHICH LPI EMITTERS (GENERALLY) CANNOT CONTROL; NAMELY, SPATIALLY COHERENT EMISSIONS. EFFECTING THE INTERFEROMETRIC (AOA) MEASUREMENT(S) VIA A CORRELATION TYPE OF PHASE DETECTOR INSURES COHERENT INTEGRATION PERFORMANCE; 35 TO 40 dB SNR ENHANCEMENT CAN BE EXPECTED FOR (HYBRID) HOP RATES OF 500 TO 1,000 HPS.

PROCESSING RESEARCH INC
8027 LEESBURG PIKE - STE 201
VIENNA, VA 22182
CONTRACT NUMBER:
DUDLEY C EDGEMON
TITLE:
UNINTENTIONAL MODULATION OF COMMUNICATION SIGNALS
TOPIC# 7 OFFICE: PM/SBIR IDENT#: 33825

THIS RESEARCH EFFORT WILL EXPLORE THE FEASIBILITY OF COLLECTION AND EXPLOITATION OF UNINTENTIONAL MODULATIONS ON CONVENTIONAL COMMUNICATION SIGNALS. PREVIOUS EFFORTS HAVE FOCUSED ON PROCESSING TO REDUCE THE INTERFERENCE THESE SIGNALS CAUSE DURING ANALYSIS OF THE VOICE SIGNAL. THIS EFFORT WILL USE NARROW BAND PROCESSING TO ENHANCE CERTAIN BACKGROUND SIGNALS AND DETERMINE IF EXPLOITATION IS FEASIBLE. PROCESSING GAINS OF OVER 20 dB ARE POSSIBLE. SUCCESSFUL EXPLOITATION OF THESE SIGNALS WILL LEAD TO THE DEVELOPMENT OF A AIRBORNE DESIGN DURING PHASE II.

QUANTEX CORP
2 RESEARCH CT
ROCKVILLE, MD 20850
CONTRACT NUMBER:
SUGANDA JUTAMULIA
TITLE:
NEW MATERIALS FOR 3D NON-VOLATILE MASS STORAGE
TOPIC# 26 OFFICE: PM/SBIR IDENT#: 33813

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WE PROPOSE THE USE OF NEW ELECTRON TRAPPING MATERIALS DEVELOPED BY QUANTEX CORPORATION TO SYNTHESIZE A 3D MASS STORAGE BASED ON A VOLUME HOLOGRAPHIC STRUCTURE. THE PROPOSED 3D MASS STORAGE IS EXPECTED TO DEMONSTRATE THE FOLLOWING FEATURES: ERASABILITY AND REAL-TIME OPERATION, STORAGE CAPACITY AS HIGH AS 10 TO THE 10TH POWER BITS/CM(3), LESS THAN 20 NS RESPONSE TIME, EFFECTIVELY NONDESTRUCTIVE READ OUT, READ AND WRITE IN 2D FORMAT, AND COST EFFECTIVENESS.

SAN DIEGO SEMICONDUCTORS INC

7408 TRADE ST

SAN DIEGO, CA 92121

CONTRACT NUMBER:

DR JACK F BUTLER

TITLE:

CdTe DETECTOR ARRAY FOR PASSIVE IMAGING OF SPATIALLY-DISTRIBUTED RADIATION SOURCES

TOPIC# 5

OFFICE: PM/SBIR

IDENT#: 33861

A NEW CRYSTAL GROWTH METHOD IS BELIEVED TO PRODUCE CdTe CRYSTALS WITH THE QUALITY AND HOMOGENEITY REQUIRED FOR LARGE AREA GAMMA-RAY DETECTOR ARRAY FABRICATION. THE OVERALL PROGRAM GOAL IS TO DEVELOP AND CHARACTERIZE A TWO-DIMENSIONAL MATRIX ARRAY SUITABLE FOR DOD APPLICATIONS (E.G., 2500 1-mm(2) ELEMENTS ON A 50 cm(2) SUBSTRATE). THE PHASE I EFFORT IS DESIGNED TO DEMONSTRATE FEASIBILITY BY DEVELOPING AND TESTING A ONE DIMENSIONAL ARRAY OF 1-mm X 10-mm STRIPES ON A 1 cm(2) SUBSTRATE. THE EFFORT WILL INCLUDE CRYSTAL PROCESSING, DEVELOPMENT OF A SUITABLE PHOTO-LITHOGRAPHIC TECHNIQUE TO PRODUCE THE STRIPES, DEVELOPMENT OF APPROPRIATE PREAMPLIFIER ELECTRONICS, AND THOROUGH CHARACTERIZATION, INCLUDING IMAGING STUDIES WITH A PINHOLE APERTURE. IN ADDITION TO DEMONSTRATING FEASIBILITY, PHASE I WILL YIELD TECHNOLOGICAL ADVANCES AND FUNDAMENTAL DATA NEEDED FOR SUBSEQUENT PHASE II PROGRESS.

SCIENCE & TECHNOLOGY ASSOCS INC

1700 N MOORE ST - STE 1920

ARLINGTON, VA 22209

CONTRACT NUMBER:

ALAN GLASSER

TITLE:

HIGH VELOCITY SHORT RANGE ANTI-TANK ROUND

TOPIC# 12

OFFICE: PM/SBIR

IDENT#: 33792

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A CONCEPT IS PRESENTED OF A RECOILLESS LAUNCHED ANTI-TANK PROJECTILE CAPABLE OF ENGAGING FRONTAL ARMOR OR OF A MAIN BATTLE TANK. TWO INNOVATIONS ARE BROUGHT TOGETHER IN A UNIQUE CONFIGURATION THAT PROVIDES A VERY LONG ROD PENETRATOR AT AN IMPACT VELOCITY IN EXCESS OF TWO KILOMETERS PER SECOND. THE ESTIMATED WEIGHT OF THE PROJECTILE IS 10 KILOGRAMS, ITS LENGTH IS 88 CENTIMETERS. IT IS EXPECTED THAT THE PROJECTILE WILL BE LAUNCHED FROM A 106 MM RECOILLESS RIFLE USING A STANDARD CARTRIDGE CASE AND A PROPELLANT SUCH AS M10 OR T28. ACCURACY AND HENCE EFFECTIVE RANGE IS EXPECTED TO BE LIMITED TO ABOUT ONE KILOMETER. LOW COST ERROR COMPENSATION TECHNIQUES CAN BE USED TO INCREASE THE MAXIMUM EFFECTIVE RANGE TO TWO KILOMETERS. THESE ARE NOT PART OF THIS ORIGINAL PROPOSAL EFFORT.

SCS TELECOM INC
107 HAVEN AVE
PORT WASHINGTON, NY 11050
CONTRACT NUMBER:
DR TUVIA APELEWICZ

TITLE:

TECHNIQUES AND DESIGN FOR WIDE-BAND CORRELATION OF DIGITAL OR ANALOG DATA STREAMS

TOPIC# 31 OFFICE: PM/SBIR IDENT#: 33808

A NEW TECHNIQUE FOR PERFORMING REAL-TIME WIDE-BAND CORRELATION IS PROPOSED. THE TECHNIQUE IS BASED ON THE USE OF HIGH SPEED ANALOG OPTICAL TECHNOLOGY TO PERFORM HIGH SPEED AND RELATIVELY LOW TIME-BANDWIDTH PRODUCT ANALOG CONVOLUTION OR CORRELATION, TOGETHER WITH OPTICAL INTERCONNECT DEVICES TO PERFORM APPROPRIATE DATA ROUTING AND PERMUTATION OPERATIONS. ADDITIONALLY, THIS CONCEPT INCLUDES THE USE OF MODERN, HIGHLY-PARALLEL, NUMER-THEORETIC CONCEPTS BASED ON LARGE-SCALE FFT ALGORITHMS TO DECOMPOSE THE LARGE SCALE-WIDE-BAND CORRELATION INTO A SET OF PARALLEL LOW-TIME BANDWIDTH PRODUCT FFT-LIKE OPERATIONS. THE PROPER COMBINATION OF ALGORITHMS DESIGN TOGETHER WITH THE HIGH-SPEED ANALOG OPTICAL TECHNOLOGY PROMISES OVER ONE MILLION DATA/SIGNAL POINT REAL-TIME CORRELATION OPERATIONS. A SMALL-SCALE, PROOF-OF-PRINCIPLE EXPERIMENT IS ALSO PROPOSED.

SENSIS CORP
5793 WIDEWATERS PKWY
DEWITT, NY 13214
CONTRACT NUMBER:
RICHARD KINSEY

TITLE:

RADAR CROSS-SECTION REDUCTION TECHNIQUES APPLICABLE TO IN-BAND ANTENNA SCATTERING

TOPIC# 23 OFFICE: PM/SBIR IDENT#: 33844

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THE RADARS EMBEDDED IN VERY LOW OBSERVABLE PLATFORMS MUST NOT COMPROMISE "STEALTHINESS" BY THE RADAR CROSS-SECTION (RCS) OF THEIR ANTENNAS. SUCH ANTENNAS CAN BE COVERED WITH A METALLIC RADOME THAT MINIMIZES THE RCS TO OUT-OF-BAND THREAT RADAR SIGNALS. BUT IT CANNOT SIMILARLY SUPPRESS INBAND SIGNALS. SUCH SIGNALS WILL PASS THROUGH THE RADOME AND BE SUBJECTED TO SCATTER BY THE ANTENNA BEHIND IT. THIS SCATTER IS A PRESENT-DAY LIMITATION TO THE PRESERVATION OF VERY LOW PLATFORM OBSERVABILITY. THIS PROPOSAL DESCRIBES A PHASED ARRAY DESIGN THAT SOLVES THIS REMAINING PROBLEM. IT RESULTS IN AN ANTENNA SYSTEM WITH A VERY LOW RCS OVER VIRTUALLY ALL ASPECT ANGLES AND POLARIZATIONS IN-BAND, AND A SIGNIFICANT RCS REDUCTION OVER THE ENTIRE THREAT RADAR BAND. MOREOVER, THE PROPOSED IN-BAND RCS REDUCTION TECHNIQUE WILL IMPOSE NO PENALTY IN RADAR PERFORMANCE. THE TECHNIQUE FOR DOING THIS INVOLVES AN ARRAY GROUND PLANE THAT IS BOTH POLARIZATION DEPENDENT AND FREQUENCY DEPENDENT. FOR CROSS-POLARIZED INCIDENT WAVES OF ALL FREQUENCIES, THE ARRAY APPEARS TO BE A GOOD MICROWAVE ABSORBER WHILE FOR CO-POLARIZED INCIDENT WAVES ABOVE-BAND, IT BECOMES VERY LOSSY. ARRAY ELEMENTS RECEIVING CO-POLARIZED SIGNALS IN-BAND ARE CONJUGATE MATCHED TO MINIMIZE SPECULAR SCATTER.

SIGNAL PROCESSING TECHNOLOGY LTD
703 COASTLAND DR
PALO ALTO, CA 94303
CONTRACT NUMBER:
BENJAMIN FRIEDLANDER
TITLE:
VSAR--A VELOCITY SENSITIVE SENSOR FOR OCEAN SURVEILLANCE
TOPIC# 44 OFFICE: PM/SBIR IDENT#: 33841

WE PRESENT A NOVEL SAR SYSTEM CAPABLE OF RECONSTRUCTING THE THREE-DIMENSIONAL IMAGE (RANGE, AZIMUTH, AND VELOCITY) FOR A SCENE CONTAINING MOVING SCATTERERS. THE PROPOSED SYSTEM, CALLED VSAR (FOR VELOCITY SAR), MAKES IT POSSIBLE FOR THE FIRST TIME TO OBTAIN AN UNDISTORTED HIGH-RESOLUTION VIEW OF THE OCEAN SURFACE. MOST IMPORTANTLY, IT PROVIDES DIRECT OBSERVATION OF OCEAN SURFACE CURRENTS MOVING AT DIFFERENT VELOCITIES, MAKING IT POSSIBLE TO "FILTER OUT" INTERNAL WAVES AND OTHER SURFACE FEATURES INDUCED BY VESSEL MOTION, FROM THE BACKGROUND "CLUTTER" CAUSED BY AMBIENT OCEAN WAVES. A

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REMARKABLE FEATURE OF THE VSAR IS THAT IT USES THE SAME RADAR HARDWARE AS A CONVENTIONAL SAR, DIFFERING ONLY IN THE SUBSEQUENT PROCESSING. THANKS TO THIS FACT THE TEST AND VALIDATION OF THIS CONCEPT CAN BE PERFORMED USING AVAILABLE RADA HARDWARE, OR EVEN EXISTING SAR DATA. THUS, WE EXPECT TO BE ABLE TO DEMONSTRATE THE VSAR CONCEPT ON REAL DATA DURING THE PHASE II PROJECT.

SOLIDLITE CORP

16150 NE 85TH ST - STE 217

REDMOND, WA 98052

CONTRACT NUMBER:

LARRY G DeSHAZER

TITLE:

FOUR-LEVEL SOLID-STATE LASER IN THE 1.5-4 μ m RANGE

TOPIC# 45 OFFICE: PM/SBIR IDENT#: 33869

MULTI-SPECTRAL LASER COUNTERMEASURE SYSTEMS REQUIRE SOURCES IN THE MID-INFRARED. SOLID-STATE LASER SOURCES UNDER DEVELOPMENT ARE QUASI-THREE LEVEL LASERS, SUCH AS Tm:Ho:YAG (2.1 μ m). OPERATION OF QUASI-THREE LEVEL LASERS IS TEMPERATURE DEPENDENT AND SUCH DEVICES HAVE INCREASED THRESHOLDS AND REDUCED EFFICIENCIES AT ROOM TEMPERATURE. WE PROPOSE A FOUR-LEVEL SOLID-STATE LASER BASED ON A COMBINATION OF RARE-EARTH IONS IN A FLUORIDE HOST. PREVIOUSLY WE CONDUCTED AN INVESTIGATION OF THESE IONS DOPED INTO AN OXIDE GARNET HOST AND DEMONSTRATED THE FEASIBILITY OF THE SCHEME. THE FLUORIDE HOST SHOULD GREATLY IMPROVE THE LASER PERFORMANCE OF THE ION COMBINATION. WE WILL GROW THE CO-DOPED FLUORIDE CRYSTAL, EXAMINE ITS LASER POTENTIAL BY SPECTROSCOPY AND PERFORM A LASER PUMPED LASER EXPERIMENT. THE CO-DOPED SYSTEM WILL BE PUMPED BY VISIBLE SOURCES FOR INITIAL INVESTIGATIONS BUT CAN BE PUMPED BY GaAlAs DIODES IN THE 750-850 nm RANGE FOR HIGHER EFFICIENCY. THE LASING ION HAS FOUR EMISSION BANDS, NOT TERMINATING IN THE GROUND STATE, FROM 1.5 TO 4 μ m INCLUDING A TRANSITION IN THE 'EYE SAFE' (1.4-1.85 μ m) REGIME. THIS LASER COULD BE A DIRECT SOURCE FOR APPLICATIONS IN THE MIR AS WELL AS BEING AN EFFICIENT PUMP SOURCE FOR OPTICAL PARAMETRIC OSCILLATORS.

SPACE COMPUTER CORP

2800 OLYMPIC BLVD - STE 104

SANTA MONICA, CA 90404

CONTRACT NUMBER:

ALAN D STOCKER

TITLE:

DETECTION OF OPTICAL TARGETS IN CLUTTER USING A COMBINATION OF MOTION AND SPECTRAL DISCRIMINANTS

TOPIC# 24 OFFICE: PM/SBIR IDENT#: 33865

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WE PROPOSE TO DEVELOP AND DEMONSTRATE A NEW TECHNIQUE FOR THE DETECTION OF WEAK AIRBORNE TARGETS IN HIGHLY-STRUCTURED BACKGROUND CLUTTER USING PASSIVE ELECTRO-OPTICAL SENSORS. THIS TECHNIQUE, A FEATURE OF WHICH EMPLOYS PROCESSING OF MULTI-SPECTRAL IMAGE SEQUENCES TO EXPLOIT BOTH MOTION AND SPECTRAL DISCRIMINANTS, IS THAT IT NOT ONLY PROVIDES AN INTEGRATED APPROACH TO TARGET DETECTION, BUT ALSO PROVIDES A SYSTEMATIC FRAMEWORK FOR SELECTING THE SPECTRAL BANDS WHICH WILL YIELD MAXIMUM TARGET DETECTABILITY. THE USE OF MULTI-SPECTRAL INFORMATION SIGNIFICANTLY ENHANCES THE PERFORMANCE OF EXISTING SPATIOTEMPORAL MATCHED-FILTERING (TRACK-BEFORE-DETECT) METHODS. THIS FULLY ADAPTIVE, HIGHLY-ROBUST TECHNIQUE CAN EXPLOIT ANY MEASURABLE DIFFERENCES IN SPECTRAL ENERGY DISTRIBUTION BETWEEN TARGET AND BACKGROUND RADIATION THAT ARE PRESENT AT THE MOMENT OF VIEWING, WHETHER KNOWN OR UNKNOWN. SUCH DIFFERENCES CAN BE CAUSED BY A VERY LARGE NUMBER OF FACTORS, INCLUDING DIFFERENCES IN TEMPERATURE, EMISSIVITY, PROJECTED AREA, REFLECTIVITY, ATMOSPHERIC, ETC. THE PROCESSING TECHNIQUE UTILIZES ALGORITHMS WHICH ARE INHERENTLY INDEPENDENT OF SIGNATURE PHENOMENOLOGY AND WHICH PROVIDE THEORETICALLY OPTIMUM PERFORMANCE. PROOF-OF-CONCEPT STUDIES AND COMPUTER SIMULATIONS SHOW THE POSSIBILITY OF SIGNAL-TO-CLUTTER RATIO ENHANCEMENT IN EXCESS OF 25 dB.

SPARTA INC
3440 CARSON ST - STE 300
TORRANCE, CA 90503
CONTRACT NUMBER:
IRVING B OSOFSKY

TITLE:

HIGH VELOCITY ANTITANK ROCKET HAVING A VERY LOW MINIMUM EFFECTIVE RANGE

TOPIC# 12 OFFICE: PM/SBIR IDENT #: 33788

FOR TACTICAL WEAPONS SUCH AS ANTITANK ROCKETS, IT IS IMPERATIVE THAT THE BOOST PHASE OF FLIGHT BE AS SHORT AS POSSIBLE TO MAKE A KINETIC ENERGY WEAPON EFFECTIVE AGAINST NEARBY TANKS. HIGH BOOST ACCELERATION STRESSES ROCKET PROPELLANT GRAINS TO FAILURE BY CRACKING AND SEPARATION FROM THE CHAMBER WALLS. PROPELLANT STRESSES LIMIT MAXIMUM ACCELERATION. CONVENTIONAL ROCKETS ARE STRESS LIMITED TO

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MAXIMUM ACCELERATIONS "500 g AND MINIMUM BURN TIMES "0.5 SECONDS.
SPARTA PROPOSES A NOVEL DESIGN THAT CAN ACCELERATE AT LEVELS GREATER
THAN 20,000 g AND THAT HAVE BURN TIMES LESS THAN 10 MILLISECONDS.
THE SPARTA SOLUTION TO THE DESIGN OF HIGH ACCELERATION VERY SHORT
BURN TIME ROCKETS IS TO USE AVAILABLE FULLY DEVELOPED GRANDULAR GUN
PROPELLANT AND CHANGE THE BASIC DESIGN OF THE ROCKET MOTOR.
GRANDULAR GUN PROPELLANTS WOULD BE LOADED INTO A ROCKET MOTOR CASE
WITH AN INTEGRAL SUBMERGED NOZZLE WHOSE ENTRANCE IS NEAR THE TOP OF
THE MOTOR DOME. ACCELERATION INDUCED INERTIA FORCES WOULD KEEP THE
PROPELLANT WITHIN THE MOTOR CAVITY AND ONLY GASES WOULD EXIT THROUGH
THE NOZZLE. BY THIS MEANS, IT IS POSSIBLE TO ACHIEVE 6000 FPS IN
"10 MILLISECONDS AT A RANGE OF APPROXIMATELY 30 FEET.

SPARTA INC
23041 AVENIDA DE LA CARLOTA - STE 400
LAGUNA HILLS, CA 92653
CONTRACT NUMBER:
BARBARA ADAMS
TITLE:
GENERIC SOFTWARE TOOL TO REVIEW DOCUMENTS FOR SECURITY MARKINGS
TOPIC# 6 OFFICE: PM/SBIR IDENT#: 33802

THE IMPORTANCE OF GENERATING DOCUMENTS THAT ARE ACCURATELY CLASSIFIED
CANNOT BE OVERSTATED. FOR THIS REAS', THE DEPARTMENT OF DEFENSE
HAS SET UP GUIDELINES FOR MARKING CLASSIFIED DOCUMENTS THAT ARE
STANDARD THROUGHOUT THE DEFENSE INDUSTRY. THESE TWO POINTS LEAD
SPARTA TO PROPOSE A GENERIC SOFTWARE TOOL THAT WILL READ ANY
DOCUMENT GENERATED ON A WORD PROCESSOR AND SEARCH IT FOR THE
APPROPRIATE MARKINGS. FOR NON-STANDARD PAGES OF TEXT, THE DOCUMENT
WILL BE SEARCHED AND EDITED PAGE BY PAGE USING A RELATIONAL DATABASE
CONCEPT. FOR THOSE PAGES WHOSE FORMAT OCCURS IN A VARIETY OF
DOCUMENTS, THE SOFTWARE WILL INCLUDE TEMPLATES TO ALLOW FOR QUICK
AND ACCURATE INPUT.

SPARTA INC
21 WORTHEN RD
LEXINGTON, MA 02173
CONTRACT NUMBER:
DR H M HASKAL
TITLE:
MATERIAL STRUCTURES FOR 3-DIMENSIONAL NON-VOLATILE MASS STORAGE
TOPIC# 26 OFFICE: PM/SBIR IDENT#: 33867

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A NEW OPTICAL RECORDING MEDIUM CONCEPT IS PROPOSED WHICH FEATURES HIGH ACCESSIBILITY AND HIGH DATA RATE CAPABILITY. THE MATERIAL STRUCTURE CONSISTS OF A STACK OF PLANAR DYE-IN-POLYMER LAYERS SUITABLE PHASED TO OBTAIN "VOLUME LIKE" MEDIUM BEHAVIOR. THE PROPOSED MATERIAL WILL BE SUITABLE FOR HOLOGRAPHIC DATA RECORDING AT VERY HIGH DENSITIES, HAS A READ-WRITE-ERASE CAPABILITY, REQUIRES NO WET PROCESSING, IS VERY STABLE, AND LENDS ITSELF TO MASS PRODUCTION AT VERY LOW COST AND IN VERY LARGE SIZES. THE PROPOSED PHASE I PROGRAM IS DESIGNED TO ANSWER KEY QUESTIONS ABOUT THE PERFORMANCE OF THE BILAYER POLYMER MATERIAL AS A HOLOGRAPHIC GRATINGS, FOR THE FIRST TIME, ON A PLANAR POLYMER MEDIUM USING A HIGH POWER LASER DIODE. THE MEDIUM WILL BE CHARACTERIZED IN TERMS OF RESOLUTION, SENSITIVITY, AND DIFFRACTION EFFICIENCY. IN ADDITION WE WILL SIMULATE THE PERFORMANCE OF A STACK OF PLANAR POLYMER GRATINGS USING OUR BEAM PROPAGATION METHOD PROGRAM. THE SIMULATION WILL PROVIDE DATA FOR THE DESIGN OF VOLUME LIKE MEDIUM NAMELY: THE REQUIRED NUMBER OF LAYERS, THE SPACING BETWEEN LAYERS AND THE DEFORMATION OF THE LAYERS.

SPARTA INC
21 WORTHEN RD
LEXINGTON, MA 02173
CONTRACT NUMBER:
ROBERT J GRASSO
TITLE:
MULTISPECTRAL LASER DIODE PUMPED Tm:Ho:YLF LASER
TOPIC# 45 OFFICE: PM/SBIR IDENT#: 33868

THE PROGRAM PROPOSED HEREIN IS THE EXPERIMENTAL INVESTIGATION OF THE LASER DIODE PUMPED 2.0, 2.3 AND 3.8 μm Tm:Ho:YLF CASCADE LASER. THE PURPOSE OF THIS PROGRAM IS TO DEVELOP A SIMULTANEOUS, MULTIPLE WAVELENGTH MID-IR LASER SOURCE FOR USE AS AN ACTIVE COUNTER-MEASURE AGAINST ADVANCED IR SEEKING MISSILES. TO DATE, ONLY THE 2.0 AND 2.3 μm WAVELENGTHS FROM Tm:Ho:YLF HAS BEEN EXAMINED. THIS PROGRAM PROPOSES TO EXAMINE THE PREVIOUSLY UNLASED 3.8 μm Tm TRANSITION ALONG WITH THE 2.0 AND 2.3 μm WAVELENGTHS USING A LASER DIODE AS THE EXCITATION SOURCE. IN PHASE I OF THIS PROGRAM WE WILL CONSTRUCT AND CHARACTERIZE A LASER DIODE PUMPED 2.0, 2.3 AND 3.8 μm Tm:Ho:YLF CASCADE LASER. LASER CRYSTAL AND RESONATOR PARAMETERS WILL BE

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OPTIMIZED FOR EFFICIENT, MULTIPLE WAVELENGTH CASCADE LASER OPERATION AT 2.0, 2.3 AND 3.8 μ m. IN A PHASE II PROGRAM WE WILL OPTIMIZE THE MULTIPLE WAVELENGTH OPERATION FOR INCREASED OUTPUT POWER AND CHARACTERIZED OPERATION WITH AN OPO AT EACH WAVELENGTH TO EXTEND THE MULTIPLE WAVELENGTH OPERATING RANGE FURTHER INTO THE MID-IR. ALSO, Q-SWITCHING AT REPETITION RATES FROM 0.1 TO 100 KHZ WILL BE EXAMINED.

SPECTRA SYSTEMS

PO BOX 495

DAYTON, OH 45459

CONTRACT NUMBER:

PAUL D ZIDEK

TITLE:

LOW RCS ANTENNA DEVELOPMENT

TOPIC# 23

OFFICE: PM/SBIR

IDENT#: 33829

THIS SBIR PHASE I PROPOSAL OUTLINES AN APPROACH TO DEVELOP A UNIQUE LOW RADAR CROSS-SECTION ANTENNA DESIGN. THREE CANDIDATE CONFIGURATION APPROACHES ARE PRESENTED, EACH EXPLOITING A SPECIFIC DESIGN CONCEPT. THESE CANDIDATES WILL BE EVALUATED DURING PHASE I TO DETERMINE PERFORMANCE FROM BOTH A RADAR AS WELL AS THE RCS POINT OF VIEW. A COMPUTER MODEL WILL BE USED TO ASSESS THE DESIGN PERFORMANCE AND TRADE-OFFS. THE CONFIGURATIONS WILL BE RANKED ACCORDING TO PERFORMANCE, FEASIBILITY, EASE OF UPGRADE/RETROFIT AND ESTIMATED COSTS.

SPIRE CORP

PATRIOTS PK

BEDFORD, MA 01730

CONTRACT NUMBER:

DR ANTON C GREENWALD

TITLE:

IMPROVED LEAD-ZIRCONIA-TITANATE FERROELECTRIC NON-VOLATILE RAMS B MOCVD

TOPIC# 26

OFFICE: PM/SBIR

IDENT#: 33835

SMALL (256 TO 512 BYTES) NVRAMS BASED UPON FERROELECTRIC MATERIALS

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ARE NOW BEING INTRODUCED INTO THE MARKET. THE LARGER MEMORIES OF INTEREST TO THE MILITARY WILL REQUIRE IMPROVEMENTS IN THE BASIC LEAD-ZIRCONIA-TITANATE MATERIAL. PHASE I OF THE PROPOSED RESEARCH WILL INVESTIGATE CVD AS A MEANS OF DEPOSITING FILMS OF EXCEPTIONAL PURITY WITH IMPROVED UNIFORMITY IN COMPOSITION, STRUCTURE, AND THICKNESS. PHASE II RESEARCH WOULD STUDY MATERIAL INTERACTIONS WITH CONTACTS OR ELECTRODES OF FERROELECTRIC DEVICES AS WELL AS EXPLORING THE ELECTRICAL PROPERTIES OF CVD FILMS.

SWERLING MANASSE & SMITH INC
21515 VANOWEN ST - STE 212
CANOGA PARK, CA 91303

CONTRACT NUMBER:

DR ROBERT MILTON

TITLE:

RADAR DETECTION OF INTERNAL WAVES USING HORIZONTAL POLARIZATION
AT LOW GRAZING ANGLES

TOPIC# 44 OFFICE: PM/SBIR IDENT#: 33806

A RELATIVELY UNEXPLORED, BUT POSSIBLY VERY IMPORTANT PARAMETER REGION FOR RADAR DETECTION OF INTERNAL WAVES IS THAT OF RELATIVELY LOW GRAZING ANGLES AT HH POLARIZATION. IT IS SUGGESTED IN THE LITERATURE THAT THE FRACTIONAL MODULATION OF RCS PER UNIT AREA IS LARGE UNDER SOME CIRCUMSTANCES FOR HH POLARIZATION AT LOW GRAZING ANGLES. WE WILL INVESTIGATE THE FEASIBILITY OF THIS APPROACH USING SIMPLIFIED MODELS DEVELOPED IN LITERATURE AND COMPARE TO EMPIRICAL DATA. IN ADDITION, A PRELIMINARY EXAMINATION OF THE EFFECT OF LINEARITY ASSUMPTIONS IN THE SIMPLIFIED MODEL ON DETECTABILITY WILL BE PERFORMED. FINALLY, A SET OF EXPERIMENTS WILL BE DEFINED WHICH WILL PROVIDE DATA FOR VALIDATION OF THIS APPROACH.

SYMETRIX CORP
PO BOX 49164
COLORADO SPRINGS, CO 80949
CONTRACT NUMBER:
LARRY D McMILLAN

TITLE:

NEW MATERIALS AND IMPROVED ANNEALING PROCESSING AND CHARACTERIZATION FOR FERROELECTRIC-ON-GaAs MEMORIES

TOPIC# 26 OFFICE: PM/SBIR IDENT#: 33795

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IF THE NEW THIN-FILM PROTOTYPE FERROELECTRIC MEMORIES ARE TO BE NECESSFULLY INTEGRATED ONTO GaAs CIRCUITRY, IT WILL BE NECESSARY TO DEVELOP RAPID THERMAL PROCESSING TECHNIQUES TO PROTECT THE GaAs JUNCTIONS (A NORMAL PZT ANNEAL IS 75 MIN AT 650-750 DEG C, WHICH IS INTOLERABLE FOR GaAs DEVICES). THE PRESENT PROPOSAL IS FOR JOINT WORK WITH McDONNELL-DOUGLAS (CHOSEN BECAUSE THEIR J-FET DEVICES HAVE BETTER LEAKAGE CURRENTS AND REQUIRE NO GATE ANNEAL, IN COMPARISON WITH MESFETS). IN ADDITION TO RAPID THERMAL PROCESSING STUDIES, THE PROPOSED WORK INCLUDES BETTER CHARACTERIZATION OF FE-ON-GaAs MEMORY DEVICES (PARTICULARLY WITH REGARD TO C-V DATA) THAN HAS BEEN GIVEN TO DATE, AND THE TEST OF ONE NEW MATERIAL (BISMUTH TITANATE) AS AN ALTERNATIVE TO PZT FOR THE ACTIVE MEMORY MATERIAL.

SYSTEMS SUPPORT INC
10024 COLVIN RUN RD
GREAT FALLS, VA 22066

CONTRACT NUMBER:

ROBERT B MOLER

TITLE:

HUNTER/KILLER COUNTERMINE SYSTEM

TOPIC# 11

OFFICE: PM/SBIR

IDENT#: 33810

THE DETECTION AND NEUTRALIZATION OF LAND MINES HAS BEEN A GOAL OF RESEARCH FOR NEARLY 50 YEARS. PRESENTLY, ONLY METALLIC MINES CAN BE DETECTED, AND THEN ONLY AT A LOW SEARCH SPEED USING A HAND HELD DETECTOR. NEUTRALIZATION TECHNIQUES AVAILABLE ARE THE MINE ROLLER AND THE MINE PLOW, BOTH OF LIMITED EFFECTIVENESS AND THE LINE CHARGE, WHICH CLEARS A NARROW LANE. ADVANCES IN THE GENERATION AND SCANNING OF INTENSE ELECTRON BEAMS HAVE OPENED UP PREVIOUSLY IMPRACTICAL METHODS OF MINE DETECTION INVOLVING GAMMA-INDUCED ACTIVATION OF NITROGEN. LINACS CAPABLE OF ELECTRON ACCELERATION RESULTING IN ENERGY GAINS OF MORE THAN 5 MeV PER METER HAVE BEEN DEMONSTRATED. DETECTION AND LOCALIZATION OF A BURIED NON-METALLIC MINE WITHIN A FEW CM APPEARS POSSIBLE. RECENT DEMONSTRATION OF THE PROPAGATION OF INTENSE ELECTRON BEAMS THROUGH AIR OPEN UP THE POSSIBILITY THAT REASONABLE LOCALIZATION OF A MINE FUSE WOULD PERMIT SUCH A BEAM TO AFFECT IGNITION WITH HIGH PROBABILITY. CONSERVATION ESTIMATES OF THE POWER DENSITY IMPLY THAT A 100 Kw PULSE WITH A DURATION OF

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1 SECOND, COVERING AN AREA OF 10 SQUARE CM WOULD BE SUFFICIENT TO
INITIATE THE SENSITIVE COMPONENTS IN A FUZE.

TECHNOLOGY INTEGRATION DEV GROUP INC
ONE PROGRESS RD
BILLERICA, MA 01821
CONTRACT NUMBER:
GEORGE P SUCCI
TITLE:
ACTIVE CANCELLATION OF ROTOR ACOUSTIC SIGNATURES
TOPIC# 10 OFFICE: PM/SBIR IDENT#: 33830

A HIGHLY EFFICIENT CONCEPT IS PROPOSED WHICH WILL SUBSTANTIALLY
REDUCE ACOUSTIC SIGNATURES OF HELICOPTERS AND TILT ROTOR AIRCRAFT.
THE CONCEPT CAN BE INCORPORATED INTO FUTURE HELICOPTER DESIGNS
WITHOUT ANY OBVIOUS, WEIGHT OR PERFORMANCE PENALTIES. THE CONCEPT
WILL PRODUCE REDUCTION OF SOUND RADIATION IN ALL DIRECTIONS OVER
ALL FLIGHT SPEEDS WITH MINIMAL PROCESSING.

TRIFID CORP
744 OFFICE PKWY - STE 224
ST LOUIS, MO 73141
CONTRACT NUMBER:
DR MARSHALL B FAINTICH
TITLE:
ANALYSIS OF MULTI-SPECTRAL SPACE PHOTOGRAPHY TO DETERMINE GEOLOGI
AND GEOPHYSICAL GROUND FEATURES
TOPIC# 2 OFFICE: PM/SBIR IDENT#: 33840

METHODS ARE DEVELOPED TO APPLY SPACE BASED RIGOROUS TOPOGRAPHIC
MAPPING TECHNIQUES IN EXPLOITATION OF COMMERCIALY AVAILABLE MULTI-
SPECTRAL IMAGERY (SPOT) IN CONJUNCTION WITH TOPOGRAPHIC DATA, DMA
TERRAIN DATA (DTED), AND GEOLOGICAL MAPS, TO DO AUTOMATED GEOLOGIC
MAP UPDATES, IDENTIFICATION OF STRUCTURE LINES, TRENDS AND OTHER
LINEAR FEATURES, PERFORM LIMITED MINERAL CLASSIFICATION, AND
AUTOMATED GEOLOGIC MAPPING. METHODS TO AUTOMATICALLY DETECT
PARAMETERS THAT INDICATE RECENT DISTURBANCES ARE ALSO INVESTIGATED.

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ULTRAMET
12173 MONTAGUE ST
PACOIMA, CA 91331
CONTRACT NUMBER:
ANDREW J SHERMAN
TITLE:
ADVANCED CERAMIC FIBERS FOR INTERMETALLIC MATRIX COMPOSITES
TOPIC# 33 OFFICE: PM/SBIR IDENT#: 33880

INTERMETALLIC COMPOSITES, MOST NOTABLY THE ALUMINIDES, HAVE BEEN IDENTIFIED AS POTENTIAL ENGINE AND STRUCTURAL MATERIALS OFFERING PROPERTIES SUPERIOR TO THOSE OF THE PRESENT NICKEL- AND COBALT-BASED SUPERALLOYS. UNFORTUNATELY, CURRENTLY AVAILABLE REINFORCEMENTS ARE NOT COMPATIBLE WITH THE ALUMINIDE MATRICES, AND COMPATIBILITY AND/OR COMPLIANT INTERLAYERS MUST BE USED. TREMENDOUS ADVANTAGES CAN BE GAINED BY USING HfN OR TiC MONOFILAMENTS AS REINFORCEMENTS IN AN INTERMETALLIC MATRIX. BOTH HfN AND TiC ARE THERMOCHEMICALLY COMPATIBLE WITH TiAl(3), NiAl, AND FeAl, AND EACH CAN BE PRODUCED IN A FINE-GRAINED MONOFILAMENT. IN THIS PHASE I PROGRAM, ULTRAMET PROPOSES TO DEMONSTRATE THE FEASIBILITY OF PRODUCING HIGH-STRENGTH HfN AND TiC MONOFILAMENTS BY CHEMICAL VAPOR DEPOSITION (CVD), BY OPTIMIZING PROCESSING CONDITIONS AND SUBSTRATE PROPERTIES TO ACHIEVE MAXIMUM STRENGTH AND MATRIX COMPATIBILITY.

UNIVERSAL ENERGY SYSTEMS INC
4401 DAYTON-XENIA RD
DAYTON, OH 45432
CONTRACT NUMBER:
ERIK S BUCK
TITLE:
WIDE-BAND CORRELATOR
TOPIC# 31 OFFICE: PM/SBIR IDENT#: 33820

PHASE I WILL BUILD A PROOF-OF-PRINCIPLE "THOUSAND POINT" MODEL OF A WIDE-BAND CORRELATOR AND WILL DESIGN A CORRELATOR CAPABLE OF FINDING A KNOWN "MILLION POINT" SIGNAL AMONG MANY SIGNALS AND OF DETERMINING

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THE TIME OF BEST CORRELATION TO ONE "POINT," EVEN IN THE PRESENCE OF DOPPLER EFFECTS. THE CORRELATOR WILL USE "VIDEO DISK" TECHNOLOGY AND WILL BE SUITABLE FOR USE IN WIDE-BAND RADARS OR SONARS.

VARITRANS INTERNATIONAL CORP

5109 E LaPALMA - STE C

ANAHEIM, CA 92807

CONTRACT NUMBER:

J ROBERT LOGAN

TITLE:

INTUITIVE COCKPIT DISPLAYS FOR FIGHTER AIRCRAFT

TOPIC# 18 OFFICE: PM/SBIR IDENT#: 33847

THE PROFERRED THESIS BEHIND THIS PROPOSAL IS THAT A PILOT DOES NOT ASSIMILATE DATA FROM HIS AIRCRAFT COMPREHENSIVELY AND AT ELECTRONIC SPEEDS,, AND THIS CAN BE A CONTRIBUTING FACTOR TO MANY AIRCRAFT ACCIDENTS. ACCOMPANYING THIS STATEMENT IS THE NOTION THAT A PILOT CANNOT INGEST DATA AT "ELECTRONIC SPEEDS". THIS IS SIMPLY NOT THE CASE; WHAT A PILOT SEES TODAY IS NOT WHAT HE COULD SEE, GIVEN THE CORRECT INSTRUMENTATION. IT IS SUBMITTED THAT ONE PROPERTY OF A MAN WHICH HASNOT BEEN EXPLOITED IS HIS ADVANCED PATTERN RECOGNIZING ABILITY. THE PROPOSAL TEXT WILL POINT OUT THAT A MAN CAN RECOGNIZE A SIMPLE GEOMETRIC OBJECT, LIKE A HEXAGON, EASILY WITHIN MILLISECONDS. IF THE IMPACT OF BACKGROUND DATA CAN BE MADE TO CAUSE DEFORMATION OF THE OBJECT, THIS WILL ALSO BE RECOGNIZED WITHIN MILLISECONDS. THE BASIS OF THIS PROPOSAL IS TRANSMISSION OF DATA FROM A DYNAMIC SYSTEM INTO A MAN'S MIND ALMOST INSTANTLY BY USING THE MAN'S WELL-DEVELOPED PATTERN RECOGNIZING ABILITY TO SEE DATA IN THE DEFORMATION OF A SIMPLE GEOMETRIC FIGURE.

VOLTAIX INC

PO BOX 5357 - 197 MEISTER AVE

NORTH BRANCH, NJ 08876

CONTRACT NUMBER:

JOHN P de NEUFVILLE

TITLE:

PRECURSORS FOR ORGANOMETALLIC CHEMICAL VAPOR DEPOSITION OF COMPOU
SEMICONDUCTORS

TOPIC# 35 OFFICE: PM/SBIR IDENT#: 33821

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THE CHEMICAL VAPOR DEPOSITION OF COMPOUND SEMICONDUCTORS REQUIRES VOLATILE PRECURSOR MOLECULES, USUALLY ORGANOMETALLIC (OM) LIQUIDS OR METAL HYDRIDE (MH) GASES, WHICH CAN BE THERMALLY DECOMPOSED ON A HEATED SUBSTRATE TO PRODUCE THE REQUISITE EPITAXIAL MATERIAL GROWTH. AN INHERENT DISADVANTAGE WITH THE OM'S IS THAT THEIR DECOMPOSITION PRODUCES HYDROCARBON SPECIES WHICH CAN CONTRIBUTE CARBON IMPURITIES TO THE GROWING CRYSTAL. AN INHERENT DISADVANTAGE OF THE MH GASES IS THE DIFFICULTY OF STORING AND HANDLING TOXIC AND FLAMMABLE GASES SAFELY AT HIGH PRESSURES. FURTHERMORE, CERTAIN HYDRIDES ARE TOO UNSTABLE TO CONTEMPLATE STORAGE AS GASES AT AMBIENT TEMPERATURE, LEAVING NO APPARENT CHOICE EXCEPT THE OM OPTION. HOWEVER, WHERE THERE IS A CHOICE BETWEEN MH GASES AND OM LIQUIDS, THE MH'S (E.G. AsH[3], PH[3]) ARE STILL GENERALLY PREFERRED DUE TO THEIR HIGHER PURITY AND INHERENT ABSENCE OF CARBON CONTAMINANTS. POINT-OF-USE MH GAS GENERATORS ARE PROPOSED TO OVERCOME LIMITATIONS OF BOTH CLASSES OF CVD PRECURSORS. IN ADDITION TO THE OBVIOUS CASES OF AsH(3) AND PH(3) GENERATORS, THE POSSIBILITY OF GENERATING MORE UNUSUAL AND LESS STABLE HD'S LIKE H(2)Te AND Ga(2)H(6) APPEARS FEASIBLE. DEVELOPMENT OF SUCH MH SOURCE WOULD EXPAND THE OPTIONS FOR MOCVD PRECURSORS FOR DEPOSITION OF Hg/CdTe AND GaAs CRYSTALS. THE PHASE I OBJECTIVE IS TO EVALUATE ALTERNATIVE CHEMISTRIES FOR A POINT-OF-USE GENERATOR AND TO DETERMINE THE CONSTRAINTS INVOLVED IN GETTING A GAS STREAM CONTAINING H(2)Te INTO A CVD REACTOR WITHOUT PREMATURELY DECOMPOSING THE H(2)Te COMPONENT. THE CONTEMPLATED SOURCE CHEMISTRIES WOULD ALSO ELIMINATE THE STORAGE OF EXTREME TOXICS AT HIGH PRESSURE.

WADDAN SYSTEMS
8801 ENCINO AVE
NORTHRIDGE, CA 91325
CONTRACT NUMBER:
DR MAHENDRA SINGH

TITLE:

LOW COST ELECTRET HYDROPHONE

TOPIC# 41

OFFICE: PM/SBIR

IDENT#: 33814

RESEARCH TO DESIGN AND DEVELOP A LOW COST ELECTRET HYDROPHONE IS PROPOSED HERE. THE MAIN OBJECTIVE OF THE EFFORT IS TO DEVELOP

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MICRO-FABRICATION TECHNIQUES TO MAKE MINIATURE HYDROPHONES OF HIGH QUALITY. A SILICON WAFER IS CHEMICALLY ETCHED TO FORM A DIAPHRAGM. A METAL LAYER IS DEPOSITED TO FORM AN ELECTRET. ANOTHER METAL LAYER WAFER IS ALSO ETCHED TO FORM A DIAPHRAGM, BUT OF DIFFERENT THICKNESS. THE TWO WAFERS ARE BONDED TOGETHER TO YIELD A BATCH OF ELECTRET HYDROPHONES. SOUND WAVES PRODUCE DIFFERENT DEFORMATIONS IN THE TWO BACK-TO-BACK DIAPHRAGMS, HENCE, GENERATE A DIFFERENTIAL ELECTRICAL OUTPUT SIGNAL. A RESISTOR CONNECTED ACROSS THE METAL ELECTRODES YIELDS A SIGNAL WHEN THE SOUND WAVES IMPINGE ON THE LAYERED HYDROPHONE DIAPHRAGM.

WOOLLAM J A CO
2436 SHERIDAN BLVD
LINCOLN, NE 68502
CONTRACT NUMBER:
JOHN A WOOLLAM
TITLE:
HIGH STRENGTH 110K CERAMIC SUPERCONDUCTORS
TOPIC# 32 OFFICE: PM/SBIR IDENT#: 33863

Tl-Ba-Ca-Cu-O THIN FILMS HAVE ZERO RESISTANCE ABOVE 110K AND CRITICAL CURRENTS UP TO 10(6) A/cm(2) AT 77K. IN THICKER SAMPLES THE CRITICAL CURRENT IS LOWER. THUS, TO PREPARE STRONG, "BULK" SUPERCONDUCTORS WE ARE PROPOSING TO MAKE MULTILAYER SAMPLES COMPOSED OF STRONG SUBSTRATES (EITHER HASTALLOY OR CARBON FIBER) ON WHICH A LARGE NUMBER OF LAYERS OF SUPERCONDUCTOR AND BUFFER LAYERS HAVE BEEN DEPOSITED. THESE COMPOSITE STRUCTURES WILL BE CAPABLE OF CARRYING LARGE CURRENTS AND WITHSTANDING LARGE TENSILE STRESSES. THEY WILL BE HERMETICALLY SEALED, TO MAINTAIN LONG-TERM INTEGRITY.

DARPA

TOTAL NUMBER OF AWARDS: 100

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SUBMITTED BY

ADVANCED SCIENTIFIC CONCEPTS INC
2441 FOOTHILL LN
SANTA BARBARA, CA 93105
CONTRACT NUMBER: DNA001-89-C-0170
DR ROGER STETTNER

TITLE:

A GENERALIZED STRESS PARAMETER METHODOLOGY FOR THE SIMULATION
FIDELITY EVALUATION OF SDI SYSTEM UGTs

TOPIC# 4 OFFICE: AM IDENT#: 30881

DESIGNING A NUCLEAR SURVIVABLE, MILITARY SYSTEM DOES NOT CONSIST ONLY OF PUTTING TOGETHER "HARD" SYSTEM COMPONENTS. THE SUBSYSTEM AND SYSTEM MUST BE TESTED TO VERIFY HARDNESS. GIVEN THE DIFFICULTY IN SIMULATING NUCLEAR ENVIRONMENTS, HARDNESS VERIFICATION IS PROBABLY THE MOST DIFFICULT PART OF A SYSTEM NUCLEAR SURVIVABILITY PROGRAM. IN ADDITION, SPECIFYING SYSTEM COMPONENT HARDENING REQUIREMENTS CANNOT REALLY BE SEPARATED FROM THE TESTING PROGRAM. THERE ARE ALWAYS CONSTRAINTS LIMITING FUNDS, AND THE SYSTEM WEIGHT AND VOLUME WHICH CAN BE DEVOTED TO NUCLEAR HARDENING. THE LUXURY OF LARGE HARDENING MARGINS DOES NOT EXIST. UNDER THESE CIRCUMSTANCES, SYSTEM TESTING AND SYSTEM HARDENING ARE INEXTRICABLY BOUND. GIVEN THE DIFFICULTY IN SIMULATING THE THREAT ENVIRONMENT AND THE HARDENING MARGIN LIMITATIONS, AN IMPORTANT ISSUE IS HOW TO DEFINE AND EVALUATE THE UGT TESTS WHICH WILL ADEQUATELY VERIFY SYSTEM HARDNESS. THE QUESTION HAS NEVER BEEN ANSWERED SYSTEMATICALLY AND A DEFINITE NEED EXISTS. THIS PROPOSAL SUGGESTS A METHODOLOGY FOR ANSWERING THAT QUESTION: THE GENERALIZED STRESS PARAMETER METHODOLOGY (GPSM).

APTEK INC
1257 LAKE PLAZA DR
COLORADO SPRINGS, CO 80906
CONTRACT NUMBER: DNA001-89-C-0169
DANIEL C OSBORN

TITLE:

UGT INSTRUMENTATION FOR ELECTRICAL PARAMETER MEASUREMENT

TOPIC# 5 OFFICE: AM IDENT#: 30852

THIS PROGRAM WILL DEVELOP FIELD INSTRUMENTATION SUITABLE FOR USE IN

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AN UNDERGROUND (UGT) OR ABOVEGROUND (AGT) RADIATION TEST ENVIRONMENT, FOR THE MEASUREMENT OF ELECTRICAL PROPERTIES OF MATERIALS AS THEY RECOVER FROM IRRADIATION. THE EFFORT WILL CONSIST OF SAMPLE HOLDER AND INSTRUMENTATION DESIGN, RESPONSE ANALYSIS, AND THE FABRICATION OF A LABORATORY TEST SETUP TO SHOW TECHNIQUE FEASIBILITY.

APTEK INC
1257 LAKE PLAZA DR
COLORADO SPRINGS, CO 80906
CONTRACT NUMBER: DNA001-89-C-0134
RICHARD DONOVAN
TITLE:
SENSITIVE LOW Z STRAIN GAGE
TOPIC# 5 OFFICE: AM

IDENT#: 30858

THIS ACTIVITY WILL INVESTIGATE THE USE OF PVDF FILM FOR USE AS A LOW Z STRAIN GAGE. THE PVDF MATERIAL IS AN ORDER OF MAGNITUDE MORE SENSITIVE THAN PZT AS A PIEZOELECTRIC MATERIAL AND HAS AN ATOMIC NUMBER MUCH LOWER (LOW Z) THAN PRESENT RESISTIVE STRAIN GAGE MATERIALS. THEREFORE, PVDF AS A STRAIN GAGE WILL BE CAPABLE OF MEASURING MUCH LOWER LEVELS OF STRAIN THAN PRESENT GAGING TECHNIQUES, AND WILL BE CAPABLE OF MAKING THESE MEASUREMENTS IN HIGH DOSE SHINE THROUGH AREAS OF SPECIMENS TESTED UNDERGROUND. INCLUDED IN THIS EFFORT WILL BE FEASIBILITY STUDIES, GAGE ANALYSIS, FABRICATE SAMPLE GAGES, GAGE VERIFICATION AND CALIBRATION IN LABORATORY, AND SELECTION OF CANDIDATE GAGES FOR FURTHER VALIDATION IN PHASE II AGT AND UGT EFFORTS.

BERKELEY RESEARCH ASSOCS INC
PO BOX 241
BERKELEY, CA 94701
CONTRACT NUMBER: DNA001-89-C-0073
NINO R PEREIRA
TITLE:
A CRYOGENIC DEBRIS SHIELD FOR HIGH-FLUENCE SOFT X-RAY TESTING
TOPIC# 4 OFFICE: AM

IDENT#: 30912

A DEBRIS SHIELD MADE FROM SOLID HYDROGEN TRANSMITS MOST OF THE SOFT

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X-RAYS AROUND 1 keV PRODUCED BY A PLASMA RADIATION SOURCE. THE PROPOSAL SETS OUT TO VERIFY EXPERIMENTALLY THAT SUCH A DEBRIS SHIELD IS TECHNOLOGICALLY FEASIBLE, AND ESTIMATES THEORETICALLY THE BEHAVIOR OF THE SHIELD IN A TEST ENVIRONMENT.

BERKELEY RESEARCH ASSOCS INC
PO BOX 241
BERKELEY, CA 94701
CONTRACT NUMBER: DNA001-89-C-0110
NINO R PEREIRA
TITLE:
A TIME-RESOLVED HARD X-RAY SPECTROMETER
TOPIC# 4 OFFICE: AM IDENT#: 30913

FOR TESTING OF ELECTRONICS IT IS IMPORTANT HOW THE X-RAY ENERGY SPECTRUM FROM A BREMSSTRAHLUNG FLASH X-RAY SIMULATOR CHANGES WITH TIME. HOWEVER, ONLY THE TIME-INTEGRATED SPECTRUM CAN BE MEASURED CONVENIENTLY, USING DIFFERENTIALLY FILTERED TLD'S. THIS PROPOSAL IS TO DEVELOP A TIME-DEPENDENT VERSION OF A DIFFERENTIALLY FILTERED SPECTROMETER, BY REPLACING THE TLD'S WITH PHOTOCONDUCTIVE ELEMENTS SUCH AS GaAs.

ELECTRO MAGNETIC APPLICATIONS INC
PO BOX 260263
DENVER, CO 80226
CONTRACT NUMBER: DNA001-89-C-0176
DR RODNEY A PERALA
TITLE:
A PROPOSAL TO INVESTIGATE PHYSICAL LIMITING MECHANISMS IN NUCLEAR EXPLOSION INDUCED LIGHTNING (NEIL)
TOPIC# 1 OFFICE: AM IDENT#: 30862

NUCLEAR EXPLOSION INDUCED LIGHTNING (NEIL) REPRESENTS A POTENTIALLY SEVERE THREAT TO MILITARY SYSTEMS REQUIRED TO SURVIVE AND FUNCTION AFTER EXPOSURE IN THE SOURCE REGION OF A NUCLEAR EXPLOSION. WHEREAS THERE EXISTS SOME UNCERTAINTY ABOUT THE NATURE AND MAGNITUDE OF THE THREAT, ITS EXISTENCE IS CONCLUSIVELY DOCUMENTED IN THE FILM RECORD

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OF ATMOSPHERIC NUCLEAR TESTS IN THE PACIFIC DURING THE 1950'S. SINCE NO HARDENING STANDARD IS IN PLACE FOR IT, NEIL REPRESENTS AN AREA OF UNKNOWN VULNERABILITY FOR CRITICAL SYSTEMS WHICH WOULD OTHERWISE BE HARD TO NUCLEAR WEAPONS EFFECTS. THE DIFFICULTY WITH ESTABLISHING A USEFUL STANDARD CENTERS ABOUT THE IMMATURE STATE OF THE MODELS DESCRIBING THE EFFECT AND THE LACK OF CONVINCING EXPERIMENTAL CONFIRMATION. THE OBJECTIVE OF THE PROPOSED WORK IS TO DETERMINE THE MAXIMUM MAGNITUDE AND DURATION OF CURRENTS EXPECTED TO FLOW IN A NUCLEAR LIGHTNING EVENT. THIS GOAL WILL BE ADDRESSED THROUGH THE DEVELOPMENT OF NUMERICAL AS WELL AS ANALYTICAL MHD PLASMA MODELS OF NEIL WITH PARTICULAR EMPHASIS ON THE EFFECTS OF INSTABILITIES AND OTHER PHENOMENA THAT AFFECT CHANNEL CURRENT.

GEO-CENTERS INC
7 WELLS AVE
NEWTON CENTRE, MA 02159
CONTRACT NUMBER: DNA001-89-C-0093
BRUCE N NELSON
TITLE:
HIGH BANDWIDTH ACCELEROMETER FOR SHOCK ENVIRONMENTS
TOPIC# 5 OFFICE: AM IDENT#: 30946

THE PHASE I EXPERIMENTAL EFFORT WILL DEMONSTRATED THE FEASIBILITY OF DEVELOPING A RUGGED HIGH BANDWIDTH FIBER OPTIC BASED ACCELEROMETER FOR USE IN SHOCK ENVIRONMENTS. THE PROPOSED EFFORT WILL SEEK TO DEVELOP AN ACCELEROMETER WITH WIDE MEASUREMENT BANDWIDTH CAPABILITY AND INCREASED RUGGEDNESS COMPARED TO PRESENTLY AVAILABLE PIEZO-ELECTRIC AND PIEZO-RESISTIVE ACCELEROMETERS. THE PHASE I EFFORT WILL QUANTIFY THE EFFECT OF GLASS SAMPLE GEOMETRY ON THE PERFORMANCE CAPABILITIES OF A FIBER OPTIC ACCELEROMETER. A PROTOTYPE FIBER OPTIC ACCELEROMETER WILL BE DESIGNED, FABRICATED AND EVALUATED AS PART OF THE PHASE I PROGRAM. THE SENSOR OFFERS IMMUNITY TO THE EFFECTS OF ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC PULSE, AND A SENSOR OUTPUT THAT IS DIRECTLY COMPATIBLE WITH FIBER OPTIC DATA TRANSMISSION LINES. THE USE OF A SUM-DIFFERENCE OUTPUT DETECTION SCHEME WILL PROVIDE IMMUNITY TO SOURCE LIGHT INTENSITY VARIATIONS, OPTICAL FIBER MICROBENDING LOSSES AND THE ADVERSE EFFECTS OF RADIATION DARKENING.

HORIZONS TECHNOLOGY INC
7830 CLAIREMONT MESA BLVD
SAN DIEGO, CA 92111
CONTRACT NUMBER: DNA001-89-C-0104
PAULA L WADDELL
TITLE:
A TECHNICAL HYPERTEXT SYSTEM
TOPIC# 1 OFFICE: AM IDENT#: 30961

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HORIZONS TECHNOLOGY, INC., (HTI) PROPOSES TO EXAMINE THE BENEFITS OF APPLYING HYPERTEXT, EXPERT SYSTEM, AND MICROCOMPUTER TECHNOLOGIES TO INCREASE THE EFFECTIVENESS OF SCIENTIFIC COMPUTING AND COMPUTATIONAL AIDS (CAP) AND BY INCREASING THE USABILITY OF REFERENCE DOCUMENTATION DESCRIBING COMPLEX NUCLEAR WEAPON EFFECTS PHENOMENOLOGY. A HYPERTEXT DOCUMENT ALLOWS THE USER TO EASILY ACCESS DIFFERENT TYPES OF INFORMATION, E.G., INFORMATION RELATED TO THE CURRENT FOPIC THAT IS CONTAINED IN ANOTHER PART OF THE DOCUMENT, THE RESULT OF A NUCLEAR WEAPON EFFECT CALCULATION, OR A GRAPHIC IMAGE, SUCH AS PLOTS AND SCANNED PHOTOGRAPHS. THIS RESEARCH EFFORT WILL FOCUS ON TWO CHAPTERS OF THE DEFENSE NUCLEAR AGENCY (DNA) DOCUMENT EM-1, IN PARTICULAR, CHAPTER 2, AIRBLAST PHENOMENA AND CHAPTER 5, UNDERWATER NUCLEAR EXPLOSION EFFECTS. HTI WILL EVALUATE SEVERAL NEWLY RELEASED HYPERTEXT/EXPERT SYSTEM "SHELLS" AND SELECT THE ONE BEST SUITED FOR USE IN DEVELOPING A PROOF-OF-CONCEPT DEMONSTRATION OF A FUNCTIONING HYPERTEXT/EXPERT SYSTEM USING THE ABOVE MENTIONED MATERIAL. PHASE I ESTABLISHES A SET OF PRELIMINARY REQUIREMENTS AND CULMINATES WITH THE DELIVERY OF A FUNCTIONAL PROOF-OF-CONCEPT DEMONSTRATION. PHASE II INCORPORATES USER FEEDBACK INTO A FORMAL SPECIFICATION FOR THE PRODUCT AND CULMINATES WITH THE DELIVERY AND DEMONSTRATION OF A PROTOTYPE SYSTEM INCLUDING AN EXPANDED DATABASE OF "HYPERTEXTED" DOCUMENTATION MATERIALS. PHASE III DEVELOPS AND INSTALLS THE PRODUCTION SYSTEM ON THE SELECTED HOST HARDWARE AND INCLUDES THE TRANSLATION OF AN AGREED UPON SET OF DOCUMENTS INTO HYPERTEXT FORMAT. A VIDEO TAPE ILLUSTRATING SOME OF THE PROPOSED HYPERTEXT CONCEPTS, IS INCLUDED WITH THIS PROPOSAL.

IBIS TECHNOLOGY CORP
32A CHERRY HILL DR
DANVERS, MA 01923
CONTRACT NUMBER: DNA001-89-C-0103
DR ANDREW B WITTOWER
TITLE:
CONTOURING THE OXYGEN ION ENERGY TO OBTAIN IMPROVED SIMOX MATERIA
TOPIC# 3 OFFICE: AM IDENT#: 30842

A PROGRAM IS PROPOSED TO EVALUATE THE FEASIBILITY OF FORMING IMPROVED SIMOX MATERIAL BY CONTOURING THE ENERGY OF THE INCIDENT OXYGEN IONS.

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DURING THE IMPLANTATION PROCESS OF SIGNIFICANT AMOUNT OF SUBSTRATE MATERIAL IS REMOVED BY SPUTTERING. ALTHOUGH THE RANGE $R(p)$ OF INCIDENT IONS REMAINS CONSTANT, TO FIRST ORDER, DURING THE IMPLANT, THE SPUTTERING AWAY OF THE SURFACE CAUSES INCIDENT IONS TO COME TO REST DEEPER AND DEEPER INTO THE SUBSTRATE. THE MAIN FOCUS OF THIS PROPOSAL IS TO STUDY THE EFFECT OF A STEPWISE REDUCTION IN THE BEAM ENERGY TO COMPENSATE FOR SURFACE EROSION BY SPUTTERING. THIS IS EXPECTED TO RESULT IN THE FORMATION OF A CONTINUOUS BURIED DIELECTRIC LAYER AT A LOWER DOSE I.E. USING A SHORTER IMPLANT TIME AND THUS AT A REDUCED COST. A SUBSIDIARY GOAL WILL BE TO STUDY THE EFFECT OF INCREASING THE BEAM ENERGY DURING THE IMPLANT THEREBY ENHANCING THE EFFECT OF SPUTTERING. THIS TECHNIQUE IS EXPECTED TO RESULT IN THE FORMATION OF A THICKER INSULATING LAYER WITH HIGHER BREAKDOWN STRENGTH. WAFERS WILL BE IMPLANTED, ANNEALED AND THE THICKNESS OF THE SURFACE SILICON LAYER AND THE BURIED OXYGEN LAYER WILL BE MEASURED. THIS STUDY WILL FORM THE BASIS FOR A PHASE II PROGRAM DURING WHICH THE PROCESSES WILL BE REFINED AND EXTENSIVE ANALYTICAL QUALITY STUDIES OF THE LAYERS WILL BE STUDIED, AND TEST DEVICES FABRICATED.

IMAGING SCIENCE TECHNOLOGIES
PO BOX 8175 - 1425 SEMINOLE (S#310)
CHARLOTTESVILLE, VA 22906
CONTRACT NUMBER: DNA001-89-C-0142
MICHAEL D LOCKHART
TITL .
REAL-TIME DRY PROCESS NON-LIGHT SENSITIVE X-RAY FILM
TOPIC# 12 OFFICE: AM IDENT#: 30896

BOTH CURRENT (INF) AND PROPOSED (SALT) ARMS CONTROL TREATIES WILL REQUIRE MEANS OF VERIFICATION AND COUNTING OF MISSILES. CURRENT PROVISIONS PRECLUDE LOOKING INSIDE VEHICLES AND UNDER COVERS. ONE METHOD OF VISUALIZING CONTENTS WILL BE BY X-RAY, HOWEVER, CURRENT X-RAY FILMS ARE LIGHT-SENSITIVE AND REQUIRE CHEMICAL PROCESSING AND BECAUSE OF THIS, MAY NOT BE SUITABLE FOR DIFFICULT ENVIRONMENTS IN THE USSR FOR RAPID ASSESSMENT OF VEHICLE CONTENTS. ALSO, A NEED EXISTS TO DISTINGUISH BETWEEN NUCLEAR-ARMED AND CONVENTIONAL CRUISE MISSILES. ONE PROPOSED SOLUTION IS A RADIATION-SENSITIVE DOSIMETRIC TAG ATTACHED TO CONVENTIONALLY ARMED MISSILES WHICH CHANGE COLOR IF

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A NUCLEAR WARHEAD WERE SUBSTITUTED. THE CONTRACTOR PROPOSES TO ADAPT ITS USP 4,699,872 FOR AN INSTANT NON-SILVER, DRY PROCESS X-RAY FILM USING THERMAL DEVELOPMENT INTO A REAL-TIME FILM BASED ON ADVANCED CHEMISTRY TECHNIQUES. PROVING THE FEASIBILITY OF THIS WOULD ALSO PROVE THE FEASIBILITY OF HAVING A RADIATION-SENSITIVE, COLOR CHANGE, DOSIMETRIC TAG.

SPIRE CORP
PATRIOTS PAKE
BEDFORD, MA 01730
CONTRACT NUMBER: DNA001-89-C-0100
DR FEREYDOON NAMAVAR
TITLE:
LOW COST IMPROVED SIMOX MATERIAL BY HIGH-CURRENT-DENSITY HIGH-TEMPERATURE IMPLANTATION
TOPIC# 7 OFFICE: AM IDENT#: 30798

SPIRE HAS RECENTLY DEMONSTRATED THAT SIMOX WAFERS OF SUFFICIENTLY HIGH QUALITY AND LOW DEFECT DENSITY TO SUPPORT BIPOLAR DEVICE APPLICATIONS CAN BE PRODUCED. TO ACHIEVE SUPERIOR QUALITY, HOWEVER, PRESENTLY REQUIRES PRODUCTION METHODS WHICH RESULT IN RELATIVELY HIGH COST. A RESEARCH PROGRAM IS PROPOSED WHICH WILL ESTABLISH THE FOUNDATION FOR LOWER COST, HIGHER THROUGHPUT PRODUCTION ALTERNATIVES WHICH PRESEVE BIPOLAR QUALITY. THE STANDARD IMPLANTATION PROCESS RESULTS IN SIMOX MATERIAL WITH DEFECT DENSITIES OF ABOUT $10(9)/CM(2)$; IT IS KNOWN THAT SIMOX WITH LOWER DEFECT DENSITIES CAN BE PRODUCED USING IMPLANTATION TEMPERATURES OF 600 DEG C TO 700 DEG C. TO UTILIZE THE MAXIMUM POWER OF A HIGH CURRENT IMPLANTER SUCH AS AN NV-200, SPIRE HAS STUDIED FABRICATION OF SIMOX AT MUCH HIGHER IMPLANTATION TEMPERATURES: 900 DEG C TO 1000 DEG C (CURRENT DENSITY OF ABOUT 60 MICROAMPERES/ $CM(2)$). RESULTS INDICATE THAT, TO FORM BURIED LAYERS WITH SUCH HIGH BEAM CURRENT, AN INITIAL LOWER TEMPERATURE IMPLANTATION (LOWER DOSE RATE) IS REQUIRED TO PRODUCE $SiO(2)$ PRECIPITATES OR "SEEDS". PHASE I PROPOSES TO FURTHER INVESTIGATE THIS TWO STEP PROCESS BY (1) IMPLANTING A SMALL FRACTION OF THE TOTAL OXYGEN DOSE (ABOUT 1%) AT LOW TEMPERATURE TO GENERATE A FINE DISPERSION OF $SiO(2)$ PRECIPITATES, FOLLOWED BY (2) IMPLANTATION OF THE OXYGEN BALANCE AT 750 DEG C-850 DEG C.

TERRA TEK INC
400 WAKARA WAY
SALT LAKE CITY, UT 84108
CONTRACT NUMBER: DNA001-89-C-0092
GARY TORRES
TITLE:
A LABORATORY STUDY OF EXTENSION FAILURE IN NEVADA TEST SITE TUFFS
TOPIC# 11 OFFICE: AM IDENT#: 30971

SUBMITTED BY

CALCULATED GROUND MOTION FROM NUCLEAR EXPLOSIONS PREDICT THAT AT LOCATIONS NEAR THE CAVITY THE ROCK FAILURE SURFACE WILL BE ENCOUNTERED IN EXTENSION DURING LATER STAGES OF UNLOAD. THE RESULTING HOOP FRACTURES WILL PRODUCE A FAILED ROCK ZONE SURROUNDING THE CAVITY. HIGH PRESSURE CAVITY GASES COULD INITIATE A HYDRAULIC FRACTURE THROUGH THE FRACTURE ROCK WHICH, UNDER THE WORST CONDITION, WOULD LEAD TO VENTING. THE PURPOSE OF THE PROPOSED WORK IS TO EVALUATE EXTENSION STRENGTHS OF NEVADA TEST SITE TUFFS. ALTHOUGH SOME EXTENSION TESTS HAVE BEEN MADE, EXPERIMENTAL UNCERTAINTY EXISTS DUE TO LOCAL (SURFACE) FLAWS CAUSING PREMATURE SAMPLE FAILURE. IN PHASE I OF THE PROPOSED CONTRACT, TEST EQUIPMENT MODIFICATIONS NEEDED TO PERFORM THE TESTS AND TEST SAMPLES WILL BE DESIGNED AND FABRICATED. EXTENSION TESTS WILL BE PERFORMED ON TUFFS AT CONFINED PRESSURES FROM ATMOSPHERIC TO 2 KILOBARS. PRELIMINARY TESTS WILL BE PERFORMED TO EXAMINE POTENTIAL EXPERIMENTAL PROBLEMS FOR THE WORK TO BE UNDERTAKEN IN PHASE II WHERE EXTENSION WILL FOLLOW PRELOADING ALONG THE COMPLETE STRAIN-PATH HISTORIES EXPERIENCED BY ROCK NEAR-IN THE CAVITY.

VISIDYNE INC
10 CORPORATE PL - S BEDFORD ST
BURLINGTON, MA 01803
CONTRACT NUMBER: DNA001-89-C-0125
HENRY J P SMITH
TITLE:
NUCLEAR WEAPONS SIMULATION - ANALYSIS OF SATELLITE DATA TO DETERMINE STRUCTURE PARAMETERS
TOPIC# 4 OFFICE: AM IDENT#: 30830

A NUMBER OF NASA SATELLITES HAVE OBTAINED DATA WHICH CAN BE USED FOR DETERMINING AMBIENT ATMOSPHERIC DENSITY STRUCTURE PARAMETERS. AMONG THEM ARE THE ATMOSPHERIC EXPLORER SERIES (-C, -D, AND -E) AND THE SOLAR MESOSPHERIC EXPLORER (SME). IT IS PROPOSED TO ANALYZE THESE DATA TO OBTAIN ESTIMATES OF ATMOSPHERIC DENSITY SPATIAL STRUCTURE PARAMETERS, POWER SPECTRAL DENSITIES ETC. THIS WILL PROVIDE INPUTS FOR CORROBORATION OF A PORTION OF THE RECENTLY DEVELOPED DNA STANDARD STRUCTURE MODEL WHICH IS BEING INCORPORATED INTO SUCH CODES AS NORSE.

WEIDLINGER ASSOCS INC
333 - 7TH AVE
NEW YORK, NY 10001
CONTRACT NUMBER: DNA001-89-C-0086
DRS R ATKATSCH/I SANDLER
TITLE:
SUBMARINE SHOCK LETHALITY STUDIES: AN OBJECTIVE APPROACH FOR LAR STRAIN CALCULATIONS
TOPIC# 2 OFFICE: AM IDENT#: 30849

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ADVANCED STRUCTURAL MATERIALS USED IN THE FABRICATION OF SUBMARINES CAN SUSTAIN LARGE STRAINS DURING THE FORMATION PROCESS CAUSED BY EXPLOSIVE LOADINGS. THE COMPUTATIONAL SOLID MECHANICS COMMUNITY HAS RECENTLY RECOGNIZED SERIOUS SHORTCOMINGS IN CALCULATIONS USING MATERIAL MODELS IN THIS LARGE STRAIN REGION. BECAUSE OF THE IMPORTANCE OF CALCULATIONS IN UNDERSTANDING THE SHOCK RESPONSE OF SUBMARINES, IT IS IMPERATIVE TO CORRECT THIS DIFFICULTY. THE AIM OF THIS WORK IS TO ESTABLISH A CORRECT COMPUTATIONAL TREATMENT FOR FINITE ELEMENT ELASTO-PLASTIC SHELL ANALYSIS AND TO QUANTITATIVELY EVALUATE THE CONSEQUENCES OF IMPLEMENTING SUCH A TREATMENT INTO THE EPSA-II SOFTWARE.

DNA

TOTAL NUMBER OF AWARDS: 14

SUBMITTED BY

AB-TECH CORP
700 HARRIS ST
CHARLOTTESVILLE, VA 22901

CONTRACT NUMBER:

GERARD J MONTGOMERY

TITLE:

INDUCTIVELY SYNTHESIZED ABDUCTIVE NETWORKS AS NEURAL NETWORKS FOR
BATTLE MANAGEMENT SYSTEMS

TOPIC# 10

OFFICE:

IDENT#: 38114

ADVANCED COMPUTER TECHNOLOGY IS REQUIRED TO MEET THE CHALLENGES OF
DEVELOPING AN EFFECTIVE STRATEGIC DEFENSE BATTLE MANAGEMENT SYSTEM.
IN THIS EFFORT, AN ANALYSIS IS BEING MADE OF THE REQUIREMENTS,
BENEFITS, AND LIMITATIONS OF APPLYING ABDUCTIVE, DEDUCTIVE, AND
INDUCTIVE ARTIFICIAL INTELLIGENCE METHODS TO INTELLIGENT STRATEGIC
DEFENSE BATTLE MANAGEMENT. AN INITIAL DESIGN IS BEING DEVELOPED OF A
PROTOTYPE DEVELOPMENT ENVIRONMENT FOR DEVELOPING ADVANCED ABDUCTIVE,
DEDUCTIVE, AND INDUCTIVE SYSTEMS. A CENTRAL FOCUS OF THE EFFORT IS
TO DEMONSTRATE THE FEASIBILITY OF INDUCTIVELY SYNTHESIZING ABDUCTIVE
NETWORKS, A SUBCLASS OF NEURAL NETWORKS, THAT COULD MEET THE
CHALLENGES OF THE REQUIRED INTELLIGENT BATTLE SYSTEM. THERE ARE
MANY BENEFITS ATTAINABLE FROM EFFECTIVE ABDUCTIVE AND INDUCTIVE
REASONING CAPABILITIES. SINCE THESE METHODS ALLOW ONE TO DEVELOP
ADAPTIVE, REAL-TIME COMPUTER SOLUTIONS TO PROBLEMS INVOLVING
SIGNIFICANT UNCERTAINTIES, THE POTENTIAL COMMERCIAL AND GOVERNMENT
APPLICATIONS ARE NUMEROUS. SOME KEY APPLICATIONS INCLUDE ADVANCED
DECISION AIDING, BATTLE MANAGEMENT, EQUIPMENT AND MEDICAL
DIAGNOSTICS, AUTOMATED KNOWLEDGE ACQUISITION, AND DATA ANALYSIS.

ADVANCED PROJECTS RESEARCH INC

12524 WESTMONT DR

MOORPARK, CA 93021

CONTRACT NUMBER:

DR J W HUMPHREY

TITLE:

OBLIQUE DETONATION WAVE RAMACCELERATOR KINETIC ENERGY WEAPON

TOPIC# 2

OFFICE:

IDENT#: 38263

AN OBLIQUE DETONATION WAVE (ODW) RAMACCELERATOR KINETIC ENERGY

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WEAPON (KEW) IS BEING INVESTIGATED. CURRENT CONVENTIONAL TECHNIQUES SUCH AS VARIOUS TYPES OF LIGHT GAS GUNS AND CONVENTIONAL BALLISTIC TECHNIQUES ARE INADEQUATE FOR HIGH VELOCITY AND HIGH MASS (ABOVE 100 GRAMS) REQUIREMENTS. ELECTROMAGNETIC TECHNIQUES ARE MORE EXPENSIVE, HEAVIER, AND TECHNOLOGICALLY MORE COMPLEX. A PROPULSION CONCEPT IS BEING INVESTIGATED THAT IS EXPECTED TO PROVIDE THE CAPABILITY OF ACCELERATING MASSES TO SIX KS/SEC AND ABOVE. THE NECESSARY ANALYTICAL DESIGN TOOLS OF THIS CONCEPT ARE BEING DEVELOPED BASED ON THE USE OF A CONTROLLED AND STABILIZED ODW EXPECTED TO GREATLY ENHANCE LAUNCHER TECHNOLOGY AND CAPABILITY. SPECIFICALLY, THE APPLICATION OF THIS PROPULSION CONCEPT IS BEING INVESTIGATED FOR THE ACCELERATION OF TUBE-LAUNCHED PROJECTILES TO HYPERSONIC VELOCITIES. PRELIMINARY ANALYSIS INDICATES THAT CONVENTIONAL GASEOUS PROPELLANTS ARE CAPABLE OF ACCELERATING PROJECTILES OF PRACTICAL SIZE TO SIX KM/SEC PER SECOND AND BEYOND. IN THIS INVESTIGATION, THE BACKGROUND OF THE ODW PROPULSION CONCEPT IS BEING REVIEWED, AND THE PLAN TO DEVELOP THE AEROTHERMODYNAMIC DESIGN TOOLS OF THE ODW RAMACCELERATOR IS BEING OUTLINED TO ENABLE NEW KEW CONCEPTS HAVING SUPERIOR CHARACTERISTICS WITH RESPECT TO WEIGHT, COMPLEXITY, CAPABILITY, AND COST. WHEN SUCCESSFUL, THE RAMACCELERATOR WEAPON WOULD DISPLAY GREATLY ENHANCED SIMPLICITY AND ORDER OF MAGNITUDE LOWER WEIGHT AND COST THAN CURRENT TECHNIQUE WITH GREATER CAPABILITIES FOR HYPERVELOCITY LAUNCHERS. POTENTIAL COMMERCIAL APPLICATIONS INCLUDE EXPERIMENTAL HYPERSONIC TEST CAPABILITY TO STUDY PHENOMENA THAT WOULD OCCUR ON RE-ENTRY VEHICLES AND HYPERSONIC TRANSPORT VEHICLES SUCH AS THE NATIONAL AEROSPACE PLANE. IN ADDITION, THE RAMACCELERATOR COULD BE USED AS A FUTURE PLANETARY PROBE LAUNCHER, A MASS DRIVER TO EARTH ORBIT, AND HIGH IMPLUSE MATERIAL COMPACTOR.

ADVANCED RESEARCH & APPLICATIONS CORP

425 LAKESIDE DR
SUNNYVALE, CA 94086

CONTRACT NUMBER:

EDWARD D FRANCO

TITLE:

NEUTRAL PARTICLE BEAM HIT ASSESSMENT SENSOR

TOPIC# 3 OFFICE: IDENT#: 38277

AN ELECTRO-OPTIC IMAGING SENSOR AND APPLICATION OF AN EMERGING X-RAY

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OPTIC FABRICATION TECHNOLOGY IS BEING INVESTIGATED TO ACCOMPLISH THE MISSION OF HIT CONFIRMATION FOR THE INTERACTIVE DISCRIMINATION PROGRAM. THIS DETECTOR CHAIN WOULD DETECT, WITH ENHANCED BACKGROUND SUPPRESSION, A SIGNAL CHARACTERISTICS OF THE SURFACE OF OBJECTS INTERROGATED WITH A NEUTRAL PARTICAL BEAM. ANTICIPATED BENEFITS INCLUDE RAPID AND RELIABLE CONFIRMATION THAT THE PROBE BEAM INTERCEPTED A REENTRY VEHICLE OR DECOY. FEASIBILITY IS BEING DETERMINED BY THE CALCULATIONAL DESIGN OF THE DETECTOR CHAIN AND DEMONSTRATION OF A FAVORABLE SIGNAL TO NOISE RATIO, FABRICATION OF A PROTOTYPE SENSOR, AND EXPERIMENTAL EVALUATION OF THE SENSOR CONCEPT. A KEY TECHNICAL RISK ISSUE BEING RESOLVED IN THIS STUDY IS THE QUALITY OF THIN SCINTILLATOR FILMS GROWN BY CHEMICAL VAPOR DEPOSITION. AT A LATER STUDY, A BRASS BOARD DETECTOR WILL BE FABRICATED AND FIELD TESTED AT NEUTRAL PARTICLE BEAM TEST BEDS TO DETERMINE THE PERFORMANCE OF THE DEVELOPED SYSTEM. A SUCCESSFUL PROJECT WOULD PROVIDE A COST EFFECTIVE MEANS OF OBTAINING HIT CONFIRMATION AND SIMPLIFY THE TECHNICAL RISK ASSOCIATED WITH MID-COURSE INTERACTIVE DISCRIMINATION. THE TECHNOLOGY FOR THE FABRICATION OF UNIFORM THIN SCINTILLATORS COULD BE EXPLOITED FOR MANY IMAGE INTENSIFIER APPLICATIONS.

ADVANCED SCIENTIFIC CONCEPTS INC

2441 FOOTHILL LN

SANTA BARBARA, CA 93105

CONTRACT NUMBER:

DR ROGER STETTNER

TITLE:

PASSIVE ELECTROMAGNETIC DAMPER OF LARGE SPACE STRUCTURE VIBRATION

TOPIC# 12

OFFICE:

IDENT#: 38005

THE STRUCTURAL DYNAMICS AND CONTROL OF LARGE SPACE STRUCTURES (LSS) IS A MAJOR SPACE SYSTEM DESIGN ISSUE. LARGE SPACE STRUCTURES ARE USUALLY PRODUCED FROM EFFICIENT STRUCTURAL FRAMES TO MINIMIZE LAUNCH WEIGHT. HOWEVER, THESE DESIGNS TEND TO BE HIGHLY FLEXIBLE WITH VERY LOW STRUCTURAL VIBRATION MODES AND SMALL DAMPING RATIOS, AND NEED CONTROL SYSTEMS FOR VIBRATION DAMPING. IN THIS STUDY, A CONCEPT FOR PASSIVE, MECHANICAL DAMPING OF ENVIRONMENTAL AND OPERATIONAL SPACE-CRAFT DISTURBANCES IS BEING INVESTIGATED. THIS CONCEPT, THE PASSIVE ELECTROMAGNETIC DAMPER (PED), IS BASED ON THE CONVERSION OF

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MECHANICAL ENERGY TO OHMIC HEATING VIA A MAGNETIC FIELD. THIS DEVICE IS LIGHTWEIGHT, REQUIRES NO MOTION SENSORS, OR COMPUTER CONTROL AND THE PERFORMANCE IS STABLE WITH RESPECT TO ENVIRONMENTAL TEMPERATURE VARIATIONS. DAMPING RATIOS ARE EASILY CALCULABLE AND THERE ARE NO OUT-GASSING PROBLEMS. MILITARY COMMUNICATIONS AND SURVEILLANCE SYSTEMS, COMMERCIAL PLATFORMS, AND POSSIBLE THE NASA SPACE STATION PROJECT COULD BENEFIT FROM SUCCESSFUL DEMONSTRATION OF THE PASSIVE ELECTROMAGNETIC DAMPER (PED) CONCEPT.

ADVANCED TECHNOLOGY MATERIALS INC
520-B DANBURY RD
NEW MILFORD, CT 06776
CONTRACT NUMBER:
DR PETER S KIRLIN
TITLE:
BARIUM-TITANIUM OXIDE THIN FILM OPTICAL GUIDED-WAVE PHASE MODULAT
TOPIC# 11 OFFICE: IDENT#: 38278

FERROELECTRIC MATERIALS SUCH AS BARIUM TITANIUM OXIDE (BaTiO_3) HAVE ELECTRO-OPTIC COEFFICIENTS THAT ARE AN ORDER OF MAGNITUDE GREATER THAN THAT OF THE MORE COMMON LITHIUM NIOBIUM OXIDE (LiNbO_3). THEIR SUPERIOR POTENTIAL HAS NOT BEEN EXPLOITED BECAUSE THE ROUTINE GROWTH OF LARGE DEFECT-FREE OPTICAL QUALITY CRYSTALS HAS NOT BEEN ACHIEVED. IN THIS INVESTIGATION, PLANAR WAVEGUIDES ARE BEING FABRICATED FROM LEAD-DOPED BaTiO_3 THIN FILMS DEPOSITED BY METAL-ORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD). THE CHANGE IN THE INDEX OF REFRACTION OF THE FILMS IS BEING DETERMINED AND CORRELATED TO THE CONCENTRATION OF LEAD. THE RESULTS OF THIS RESEARCH WILL HELP DETERMINE THE FEASIBILITY OF PREPARING PLANAR OPTICAL WAVEGUIDES FROM LEAD-DOPED EPITAXIAL THIN FILMS OF BaTiO_3 , AS WELL AS YIELD THE NECESSARY MATERIALS TECHNOLOGY NEEDED TO FABRICATE DEPLOYABLE BaTiO_3 OPTICAL GUIDED-WAVE DEVICES. DEFENSE APPLICATIONS FOR THIS TECHNOLOGY INCLUDE OPTICAL SWITCHING AND OPTICAL DATA PROCESSING. POTENTIAL COMMERCIAL APPLICATIONS CONSIST OF PHOTONIC SWITCHES WHICH CAN BE USED TO REPLACE ELECTRONIC SWITCHING TECHNOLOGY THAT IS CURRENTLY USED IN WIDE BANDWIDTH FIBER OPTIC TELECOMMUNICATIONS SYSTEMS.

ADVANCED TECHNOLOGY MATERIALS INC
520-B DANBURY RD
NEW MILFORD, CT 06776
CONTRACT NUMBER:
DR DUNCAN W BROWN
TITLE:
GAS SOURCE MOLECULAR BEAM EPITAXIAL GROWTH OF GALLIUM NITRIDE
TOPIC# 14 OFFICE: IDENT#: 38279

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ALUMINUM GALLIUM NITRIDE (AlGa_N) IS A PROMISING RADIATION HARD, OPTOELECTRONIC MATERIAL. AlGa_N HAS A WIDE, DIRECT BAND-GAP, WITH POTENTIAL APPLICATIONS IN THE FABRICATION OF SHORT WAVELENGTH DEVICES. ITS PIEZOELECTRIC PROPERTIES AND HIGH ACOUSTIC VELOCITIES ALSO MAKE IT ATTRACTIVE FOR ACOUSTIC DEVICES. ALTHOUGH THEORETICAL EVALUATIONS OF AlGa_N CLEARLY INDICATE ITS PROMISE, ITS POTENTIAL HAS NEVER BEEN ADEQUATELY INVESTIGATED BECAUSE OF THE POOR AND IRREPRODUCIBLE QUALITY OF THE FILMS THAT ARE BEING GROWN PRESENTLY. THIS INVESTIGATION IS SEEKING TO PROVIDE EFFICIENT, PURE, LOW TEMPERATURE SOURCES FOR THE GAS SOURCE MOLECULAR BEAM EPITAXIAL (GSMBE) GROWTH OF AlGa_N AS A NEW SEMICONDUCTING MATERIAL. SUCCESSFUL GROWTH OF ELECTRONIC QUALITY AlGa_N WOULD PERMIT ITS APPLICATION TO A WIDE VARIETY OF OPTOELECTRONIC DEVICES, INCLUDING LIGHT-EMITTING DIODES AND SENSORS IN THE VISIBLE TO ULTRAVIOLET REGIONS OF THE ELECTROMAGNETIC SPECTRUM.

ADVANCED TECHNOLOGY MATERIALS INC

520-B DANBURY RD

NEW MILFORD, CT 06776

CONTRACT NUMBER:

DR PETER S KIRLIN

TITLE:

METALORGANIC CHEMICAL VAPOR DEPOSITION OF TiBaCaCuO OXIDE

SUPERCONDUCTOR

TOPIC# 15 OFFICE:

IDENT#: 38283

THE KEY TO THE MANUFACTURE OF DEVICES FABRICATED FROM SUPERCONDUCTING THIN FILMS WITH OPTIMAL AND REPRODUCIBLE PROPERTIES IS THE IDENTIFICATION OF A PROCESS THAT HAS EXACT CONTROL OF STOICHIOMETRY AND MORPHOLOGY FURTHER ADVANTAGES WOULD RESULT IF THE DEPOSITION OF THE SUPERCONDUCTOR COULD BE MADE COMPATIBLE WITH EXISTING SILICON INTEGRATED CIRCUIT TECHNOLOGY, MOCVD OFFERS THE POTENTIAL FOR EPITAXIAL GROWTH WITH EXACTING CONTROL OF FILM STOICHIOMETRY. THE ATTAINMENT OF SINGLE CRYSTAL THIN FILM GROWTH IS FAVORED BY UNIFORM NUCLEATION AND SUBSEQUENT STRAIN-FREE GROWTH. THE OBJECTIVE OF THIS PROJECT IS TO GROW THIN FILMS OF $Tl_2Ba_2Ca_2Cu_3O_{10+x}$ ON Si(100) SUBSTRATES THAT HAVE BEEN PASSIVATED WITH A LATTICE AND SYMMETRY MATCHED OXIDE. THE PHYSICAL, CHEMICAL, AND ELECTRICAL PROPERTIES

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OF THE HTSC THIN FILMS ARE DETERMINED AND CORRELATED TO THE DEPOSITION CONDITIONS AND MORPHOLOGY OF THE BARRIER LAYERS. THE RESULTS WILL ESTABLISH THE EFFICACY OF MOCVD IN PREPARING THIN FILMS OF Tl-Ba-Ca-Cu-O WITH CONTROLLED STOICHIOMETRY. THIS TECHNOLOGY WILL PERMIT THE FABRICATION OF ELECTRONIC INTERCONNECTS FOR HIGH SPEED COMPUTING, BOLOMETERS FOR THERMAL IMAGING, AND HETERODYNE DETECTORS FOR THE SUBMILLIMETER AND FAR INFRARED SPECTRA.

ADVANCED TECHNOLOGY MATERIALS INC

520-B DANBURY RD

NEW MILFORD, CT 06776

CONTRACT NUMBER:

CHARLES P BEETZ JR

TITLE:

ULTRAFAST DIAMOND FILM PHOTOCONDUCTIVE DETECTOR

TOPIC# 3

OFFICE:

IDENT#: 38284

OVER THE PAST DECADE STUDIES HAVE INDICATED THAT IT IS POSSIBLE TO UTILIZE THE ULTRAFAST (PICOSECOND) RESPONSE TIME OF A PHOTOCONDUCTOR TO DETECT AND TIME RESOLVE THE RAPID VARIATIONS OF LIGHT FROM A RAPIDLY CHANGING SOURCE SUCH AS A PULSED LASER, A LASER FUSION EXPERIMENT, A DIRECTED ENERGY WEAPON OR A NUCLEAR WEAPONS EXPLOSION. IN ADDITION TO THE RAPID TEMPORAL EVOLUTION OF THE LIGHT OUTPUT FROM SUCH SOURCES, THE INTENSITY USUALLY VARIES OVER AN EXTREMELY WIDE RANGE REQUIRING A DETECTOR THAT NOT ONLY HAS A ULTRASHORT RESPONSE TIME, BUT ALSO HAS A HIGH, YET CONSTANT, SENSITIVITY. THE PHOTOCONDUCTIVE RADIATION DETECTOR IS SIMPLE IN CONCEPT AND DESIGN COMPARED TO CONVENTIONAL RADIATION DETECTORS. THE MOST HEAVILY STUDIED PHOTOCONDUCTORS FOR RADIATION DETECTION APPLICATIONS HAVE BEEN SEMI-INSULATING SILICON, GALLIUM-ARSENIDE, AND INDIUM-PHOSPHIDE. THE MAIN LIMITATIONS OF THESE MATERIALS ARE THEIR LOW RADIATION RESISTANCE, LOW LEVELS OF MAXIMUM DC BIAS AND THERMAL RUNAWAY EFFECTS AT INCIDENT LIGHT INTENSITIES, DUE TO THEIR RELATIVELY LOW THERMAL CONDUCTIVITIES AND SMALL BANDGAPS. IN ORDER TO CIRCUMVENT THESE PROBLEMS, IT IS NECESSARY TO CONSIDER SEMICONDUCTING MATERIALS WITH WIDER BANDGAPS AND LARGE DIELECTRIC STRENGTHS THAT CAN SUPPORT HIGHER VOLTAGES. ONE OF THE MOST INTERESTING CANDIDATE PHOTOCONDUCTING MATERIALS IS DIAMOND BECAUSE OF ITS OVERWHELMINGLY SUPERIOR PHYSICAL PROPERTIES. IN THIS PROGRAM, THE PHOTOCONDUCTIVE RESPONSE

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OF DIAMOND FILMS GROWN BY PLASMA ASSISTED CHEMICAL VAPOR DEPOSITION IS BEING INVESTIGATED, AND EDITOR POTENTIAL FOR ULTRAFAST PHOTOCONDUCTIVITY RADIATION DETECTION APPLICATIONS IS BEING ASSESSED. WHEN SUCCESSFULLY DEVELOPED, ULTRAFAST RADIATION REDUCTION TECHNOLOGY WOULD HAVE APPLICATION IN NUCLEAR WEAPONS TESTING, AS WELL AS LASER DRIVEN FUSION SYSTEMS AND SPACEBORNE SURVEILLANCE SYSTEMS. THIS TECHNOLOGY COULD LEAD TO DEVELOPMENTS HIGH SPEED SWITCHING FOR PULSED LASER POWER SUPPLIES, AND PULSED MICROWAVE GENERATORS.

ADVEC CORP
PO BOX 495
LOS ALAMOS, NM 87544
CONTRACT NUMBER:
DR WILBUR K BROWN
TITLE:
SCALABLE COMPACT HIGH ENERGY DENSITY LASING SYSTEMS
TOPIC# 1 OFFICE: IDENT#: 38007

IN THIS STUDY, EXPERIMENTAL DESIGNS ARE BEING DEVELOPED TO EXPLOIT NEW CONCEPTS FOR THE EXCITATION OF LARGE VOLUME, DENSE LASING MEDIA. THE FOLLOW-ON EFFORT WILL INCLUDE FABRICATION, TESTING OF EXPERIMENTAL SYSTEMS, AND TWO SEPARATE PROOF-OF-PRINCIPLE EXPERIMENTS. SUCCESS WILL DEMONSTRATE THE FEASIBILITY OF COMPACT, HIGH ENERGY LASER SYSTEMS CAPABLE OF PULSED OR STEADY-STATE OPERATION AND WITH WAVELENGTH TUNABILITY FOR OPTIMUM ATMOSPHERIC PROPAGATION. THE COMPACT, HIGH ENERGY DENSITY CHARACTERISTICS OF THESE LASER SYSTEMS LEAD TO DEFENSE APPLICATIONS, SUCH AS STRATEGIC DEFENSE AND TACTICAL WEAPONS, AND LONG RANGE LASER RADARS. POTENTIAL COMMERCIAL APPLICATIONS INCLUDE LASER COMMUNICATIONS, REMOVAL OF HARMFUL IMPURITIES FROM THE ATMOSPHERE, OZONE PRODUCTION, ICE CLEARING FROM AIRPORTS, LARGE-SCALE CONTROLLED DEFOLIATION, SNOW AND ICE REMOVAL FROM REMOTE AREAS, AND SPACECRAFT PROPULSION.

AERODYNE RESEARCH INC
45 MANNING RD
BILLERICA, MA 01821
CONTRACT NUMBER:
DR CHARTER D STINESPRING
TITLE:
FLUORINATED DIAMOND THIN FILMS FOR TRIBOLOGICAL APPLICATIONS
TOPIC# 13 OFFICE: IDENT#: 38118

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AN APPROACH IS BEING INVESTIGATED FOR THE FLUORINATION OF DIAMOND THIN FILMS FOR TRIBOLOGICAL APPLICATIONS. THE APPROACH USES LOW PRESSURES OF F AND/OR CF_x FREE RADICALS. TO DEMONSTRATE THE FEASIBILITY OF THIS APPROACH, DATA IS BEING COLLECTED ON: FLUORINATION KINETICS, THE COMPOSITION AND STRUCTURE OF THE SURFACE AND NEAR SURFACE LAYERS, THE EFFECTS OF TEMPERATURE ON THE FLUORINATION PROCESS, AND THE THERMAL STABILITY OF THE FLUORINATION PRODUCTS. THE REACTIVITY AND STABILITY OF THE THIN FILMS IN VARIOUS ENVIRONMENTS, INCLUDING AIR, ARE ALSO BEING CHARACTERIZED. WHEN SUCCESSFUL, THIS DIAMOND THIN FILM FLUORINATION TECHNIQUE IS INTENDED TO BE INTEGRATED INTO THE THIN FILM DEPOSITION PROCESS. THE ADVANTAGES OF INTEGRATED PROCESSING INCLUDE IMPROVED MATERIALS, REDUCED PROCESS COMPLEXITY, SHORTENED PROCESSING TIME, AND REDUCE COSTS. BECAUSE WEAR AND FRICTION ARE IMPORTANT CONCERNS AFFECTING THE PROFITABILITY AND PRODUCTIVITY OF EVERY INDUSTRY, THESE THIN FILMS ADVANCES COULD HAVE SIGNIFICANT IMPACT ON THE U.S. ECONOMY.

ALL CHEMICAL ISOTOPE ENRICHMENT INC
702 S ILLINOIS AVE - STE 202-B
OAK RIDGE, TN 37830
CONTRACT NUMBER:
DR A ANDREW CAREY

TITLE:
THERMIONIC NUCLEAR SPACE REACTORS WITH ENRICHED TUNGSTEN-184
TOPIC# 4 OFFICE: IDENT#: 38286

TUNGSTEN IS AN ESSENTIAL ELEMENT IN ALL CONCEPTUAL DESIGNS FOR THERMIONIC NUCLEAR SPACE REACTORS BECAUSE OF ITS HIGHLY DESIRABLE PHYSICAL PROPERTIES INCLUDING A FAVORABLE WORK FUNCTION AT HIGH TEMPERATURES. HOWEVER, A SERIOUS DISADVANTAGE IS THE HIGH CROSS SECTION FOR THERMAL NEUTRON ABSORPTION EXHIBITED BY FOUR OF THE FIVE NATURALLY OCCURRING ISOTOPES OF TUNGSTEN. TUNGSTEN-184 IS THE ONLY ISOTOPE WITH A SMALL CROSS SECTION (2.4 MILLIBARNS); THE OTHER FOUR ISOTOPES HAVE A COMBINED CROSS SECTION OF ABOUT 80 BARNS, I.E., ROUGHLY 35,000 TIMES THAT OF TUNGSTEN-184. IF ENRICHED TUNGSTEN-184 WERE USED IN REACTOR FABRICATION, REACTOR EFFICIENCY COULD BE IMPROVED BY ORDERS OF MAGNITUDE SINCE THE TUNGSTEN COMPONENT LOCATED IN THE NEUTRON FLUX REQUIRED TO SUSTAIN THE CHAIN REACTION HAS A

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VASTLY LOWERED NEUTRON CAPTURE CROSS SECTION COMPARED TO NATURAL ABUNDANCE TUNGSTEN. IN THIS STUDY, OPTIMAL OPERATING CONDITIONS ARE BEING INVESTIGATED TO ENRICH TUNGSTEN-184 IN MULTI-KILOGRAM AMOUNTS USING GAS CENTRIFUGE TECHNOLOGY. DEVELOPMENT OF AN ENRICHMENT PROCESS FOR TUNGSTEN-184 WOULD MAKE HIGH EFFICIENCY, THERMIONIC NUCLEAR SPACE REACTORS POSSIBLE. THE PRINCIPAL BENEFIT IS THE DEPLOYMENT OF REACTORS IN THE 10-30 KILOWATT RANGE THAT WOULD BE USED FOR TRACKING DEVICES, COMMUNICATIONS SYSTEMS, .G., FOR SUBMARINES AND GLOBAL AIR TRAFFIC CONTROL, AND MANY OTHER POSSIBILITIES IN MILITARY AND CIVILIAN APPLICATIONS. THE USE OF QUIET, IN-CORE, THERMIONIC REACTORS FOR SUBMARINE POWER SYSTEMS HAS PARTICULARLY SIGNIFICANT POTENTIAL FOR THE NEAR FUTURE.

ALPHATECH INC
111 MIDDLESEX TURNPIKE
BURLINGTON, MA 01803
CONTRACT NUMBER:
ROBERT B WASHBURN JR
TITLE:
MULTIGRID METHODS FOR LARGE SCALE TRACKING AND CORRELATION
TOPIC# 10 OFFICE: IDENT#: 38122

MANY PROBLEMS IN TRACKING AND CORRELATION CAN BE POSED AS PROBLEMS OF SEARCHING A LARGE SET OF POSSIBLE SOLUTIONS TO FIND ALL THE ELEMENTS WHICH SATISFY A SPECIFIED SEARCH CRITERION. FOR EXAMPLE, THE PROBLEMS OF GATING, TRACK INITIALIZATION, DATA ASSOCIATION, AND CORRELATION CAN ALL BE CONSIDERED SEARCH PROBLEMS FOR WHICH THE SEARCH SET IS THE SET OF POSSIBLE COMBINATIONS OF MULTIPLE SCANS OF DATA AND THE SEARCH PROBLEMS GENERALLY REQUIRE A NUMBER OF BASIC COMPUTATIONS WHICH IS A POLYNOMIAL FUNCTION (OF DEGREE TWO OR HIGHER) OF THE NUMBER OF OBJECTS IN THE SCENARIO. FOR LARGE NUMBERS OF OBJECTS, SUCH AS ENCOUNTERED IN MIDCOURSE STRATEGIC DEFENSE OR LOW CROSS-SECTION AIR SURVEILLANCE, THESE CONVENTIONAL APPROACHES CAN OVERWHELM EVEN PARALLEL PROCESSING TECHNOLOGY. MULTIGRID METHODS ARE BEING DEMONSTRATED IN THIS INVESTIGATION THAT COULD BE APPLIED TO TRACKING AND CORRELATION PROBLEMS TO REDUCE CONVENTIONAL PROCESSING REQUIREMENTS BY ORDERS OF MAGNITUDE. IN THIS PROPOSED EFFORT, THE BASIC CAPABILITY OF THE MULTIGRID ALGORITHM IS BEING COMPARED TO EXISTING GATING ALGORITHMS; AND, THE COMPATABILITY IS

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BEING DETERMINED OF THE MULTIGRID ALGORITHM WITH PARALLEL PROCESSOR ARCHITECTURES. WHEN SUCCESSFUL, THE FEASIBILITY WOULD BE ESTABLISHED OF USING MULTIGRID TO REDUCE THE COMPLEXITY OF LARGE SCALE GATING BY ORDERS OF MAGNITUDE. THE PROBLEM (GATING) SELECTED FOR THIS PROOF OF CONCEPT IS SIGNIFICANT IN ITSELF, AND POSITIVE RESULTS WILL PROVIDE A USEFUL CAPABILITY FOR TRACKING SYSTEMS. THE MOST SIGNIFICANT ANTICIPATED BENEFIT OF THE MULTIGRID ALGORITHM IS THE APPLICATION TO REAL-TIME TRACKING FOR STRATEGIC DEFENSE AND OTHER LARGE SCALE TRACKING PROBLEMS (E.G., AIRBORNE RADAR SURVEILLANCE AND LOW OBSERVABLE TRACKING).

AMHERST SYSTEMS INC
30 WILSON RD
BUFFALO, NY 14221
CONTRACT NUMBER:
CESAR BANDERS
TITLE:
FOVEAL MACHINE VISION SYSTEMS
TOPIC# 10 OFFICE:

IDENT#: 38128

MILITARY APPLICATIONS OF COMPUTER VISION SYSTEMS REQUIRE ORDERS OF MAGNITUDE IMPROVEMENT IN CAPACITY AND SPEED OVER CURRENT SYSTEM PERFORMANCE. THE PRINCIPLE OBSTACLES TO HIGHER PERFORMANCE ARE: THE LARGE AMOUNTS OF IMAGE DATA TO BE PROCESSED; IMAGERS UNOPTIMIZED FOR THE VISION TASKS (TARGET DETECTION, CLASSIFICATION, RECOGNITION, IDENTIFICATION AND TRACKING); AND OPEN-LOOP SYSTEM ARCHITECTURE. IN THIS STUDY, A CLASS OF MUTUALLY OPTIMIZED IMAGERS AND IMAGE PROCESSING ALGORITHMS COLLECTIVELY CALLED FOVEAL VISION SYSTEMS ARE INVESTIGATED. THESE SYSTEMS, MODELED AFTER ADVANCED BIOLOGICAL VISION, FEATURE SPACE-VARIANT (VARIABLE RESOLUTION) IMAGER TOPOLOGIES AND A CLOSED-LOOP SYSTEM ARCHITECTURE. THE IMAGER TOPOLOGY IS CHARACTERIZED BY HIGH RESOLUTION SAMPLING AT THE CENTER OF THE SAMPLING PATTERN AXIS IS CONTROLLED BY FEEDBACK FROM THE IMAGE PROCESSING ALGORITHMS, ALLOWING THE ALLOCATION OF SAMPLING RESOURCES TO THE REGION(S) OF INTEREST AND RESULTING IN GREATER RELEVANT INFORMATION FROM THE IMAGER AT ORDERS OF MAGNITUDE REDUCTION IN DATA. CLOSED-LOOP OPERATION ALSO PERMITS THE FOVEAL VISION SYSTEM TO ADAPTIVELY OPTIMIZE ITS PERFORMANCE TO THE GIVEN VISION TASKS. IMAGER TOPOLOGIES WITH DIFFERENT SAMPLING ELEMENT GEOMETRIES, CORE

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CONFIGURATIONS, AND RESOLUTIONS ROLL-OFF FUNCTIONS ARE INVESTIGATED WITH DIFFERENT FEEDBACK CONTROL FUNCTION (BAYESIAN LEARNING, MAXIMUM LIKELIHOOD, NON-PARAMETRIC). THEIR RELATIONSHIP WITH OVERALL VISION SYSTEM PERFORMANCE IS BEING ASSESSED. WHEN FULLY DEVELOPED, THE CLASS OF COMPUTER VISION SYSTEMS CAN PERFORM HIGHER LEVEL VISION TASKS THAN CONVENTIONAL VISION SYSTEMS, WITH LESS PROCESSING TIME, HARDWARE, AND DATA. SYSTEM PERFORMANCE COULD BE SUBSTANTIALLY IMPROVED THROUGH ADAPTIVE SENSOR AND PROCESSING RESOURCE ALLOCATION. ... MOREOVER, THE SAVINGS FACTOR INCREASES WITH FIELD-OF-VIEW AND RESOLUTION WOULD MAKE SUCH SYSTEM PARTICULARLY ATTRACTIVE IN LARGE-SCALE FOCAL PLANE ARRAY APPLICATIONS.

ANALYTIC POWER CORP
PO BOX 1189
BOSTON, MA 02117
CONTRACT NUMBER:
DAVID BLOOMFIELD
TITLE:
ELECTROCHEMICAL CRYOCOOLER
TOPIC# 3 OFFICE:

IDENT#: 38290

A CLOSED CYCLE CRYOCOOLER IS BEING INVESTIGATED USING AN APPROACH THAT COMBINES ELECTROCHEMICAL COMPRESSOR AND EJECTOR TECHNOLOGIES. AN ELECTROCHEMICALLY INACTIVE CRYOGEN IS BEING USED IN A UNIQUE TERNARY REFRIGERANT. LIKE OTHER ELECTROCHEMICALLY-DRIVEN REFRIGERATION SYSTEMS UNDER DEVELOPMENT, THIS SYSTEM HAS NO MOVING PARTS. THE SYSTEM IS DESIGNED TO REACH A TEMPERATURE OF 77K, BUT A SIMPLE MODIFICATION IS EXPECTED TO ALLOW COLD HEAD TEMPERATURES OF 10 TO 20K. PRELIMINARY SYSTEMS STUDIES HAVE SHOWN THAT 10 WATTS (COOLING)/100 WATTS OF INPUT POWER IS A REASONABLE EFFICIENCY GOAL AS ARE 4 WATTS (COOLING)/LB AND 0.4 WATTS (COOLING)/CUBIC INCH. IN THIS EFFORT, A SINGLE STAGE OF THE COMPRESSOR IS BEING CONSTRUCTED AND TESTED TO DEMONSTRATE THE CAPABILITY OF COMPRESSING AN ELECTROCHEMICALLY INACTIVE GAS WITH AN ELECTROCHEMICAL COMPRESSOR. CRYOGEN PURIFICATION METHODS ARE ALSO BEING EXPLORED TO PROVIDE A CRYOCOOLER WITH SUFFICIENT ENDURANCE FOR LONG TERM MISSIONS. WHEN SUCCESSFUL, THE ELECTROCHEMICAL CRYOCOOLER WOULD PROVIDE A COMPACT, EFFICIENT AND HIGHLY RELIABLE SYSTEM FOR USE IN BOTH LONG AND SHORT TERM MISSIONS. THE ELECTROCHEMICAL CRYOCOOLER WOULD BE OF GREAT

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IMPORTANCE TO THE ELECTRONICS INDUSTRY WHERE COMPLEMENTARY METAL
OXIDE SEMICONDUCTOR (CMOS) SPEED INCREASES OF THREE TO FOUR ARE
POSSIBLE.

ANDROMEDA CORP
8302 WHITESBURG DR - STE B
HUNTSVILLE, AL 35802
CONTRACT NUMBER:
ROBERT E HOWLE
TITLE:
LONG PULSE LASER AMPLIFIER FOR LASER RADAR APPLICATIONS
TOPIC# 3 OFFICE: IDENT#: 38022

A METHOD FOR CREATING AND AMPLIFYING LONG PULSE LASER WAVEFORMS
(CO₂, UV LASER, ETC.) IS BEING INVESTIGATED THAT COULD ELIMINATE
AUXILIARY E-BEAM IONIZATION AND OPTICAL ISOLATION PROBLEMS
ASSOCIATED WITH A MASTER OSCILLATOR/POWER AMPLIFIER (MOPA) CON-
FIGURATION. FREQUENCY STABILITY COULD ALSO BE IMPROVED BY REMOVING
MOST LIMP INDUCED FREQUENCY CHIRP. THE METHOD COULD BE CAPABLE OF
PRODUCING A HIGH POWER (5-30+ KW), HIGH QUALITY, DIFFRACTION LIMITED
OUTPUT BEAM. THE HARDWARE CONFIGURATION IS COMPATIBLE WITH A
REASONABLY COMPACT, LIGHTWEIGHT DEVICE SUITABLE FOR AIRBORNE OR
SPACE BASED LASER RADAR APPLICATIONS. WHEN SUCCESSFUL, THIS
RADICALLY DIFFERENT TECHNICAL APPROACH, WITH ITS LOWER COST WOULD
SIGNIFICANTLY IMPACT CURRENT LASER RADAR TRANSMITTER TECHNOLOGY.
THIS CONCEPT PROVIDES THE POTENTIAL FOR ORDERS OF MAGNITUDE
IMPROVEMENT IN LASER PERFORMANCE PARAMETERS.

ANTROPIX CORP
30 MEADOWFAIR CT
THE WOODLANDS, TX 77381
CONTRACT NUMBER:
DR TERRY KUNZ
TITLE:
SHORT WAVELENGTH HYDROGEN FLUORIDE CHEMICAL LASERS
TOPIC# 1 OFFICE: IDENT#: 38294

SHORT WAVELENGTH CHEMICAL LASERS (SWCLs), BASED ON OVERTONE

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ASSISTIONAL TRANSITIONS OF HIGHLY VIBRATIONALLY EXCITED (HVE) HYDROGEN FLUORIDE (HF), ARE BEING DEVELOPED IN THIS INVESTIGATION. THESE HVE HF SWCLs REPRESENT AN EXTENSION OF MATURE CHEMICAL LASER TRECHNOLOGY (ALPHA) AND NEAR-TERM CHEMICAL LASER TECHNOLOGY (ZENITH BLUE) AND PROVIDE HIGHER SPECTRAL BRIGHTNESS AND HIGHER LETHALITY THAN THEIR LONGER WAVELENGTH COUNTERPARTS. OTHER SYSTEM ADVANTAGES INCLUDE EXCELLENT ATMOSPHERIC PROPAGATION, HIGH EFFICIENCY, SPECIFICITY, AND YIELD. THIS RESEARCH IS DEMONSTRATING LASER ACTION USING HVE HF GENERATED BY THE F+HI CHEMICAL REACTION. A SUBSONIC CW HF CHEMICAL LASER SYSTEM, TOGETHER WITH A TUNABLE CW DYE PROBE LASER SYSTEM, IS BEING USED TO: MEASURE OPTICAL GAINS AS A FUNCTION OF REAGENT AND DILUENT DENSITIES, FLOW CONDITIONS, AND OTHER DEVICE PARAMETERS; AND, DEMONSTRATE EFFICIENT EXTRACTION OF HVE HF EXCITED STATE POPULATIONS AND INVERSION DENSITIES. THIS EFFORT IS ALSO ADDRESSING EVEN MORE EXOERGIC CANDIDATE CHEMICAL REACTIONS THAT ARE SUITABLE FOR PRODUCTION OF HIGH POWER HF SWCLs. WHEN SUCCESSFULLY DEVELOPED, THE HVE HF SWCL WOULD BE INVALUABLE FOR DETERMINING ESSENTIAL SWCL PERFORMANCE PARAMETERS SUITABLE FOR GENERATING NEW HIGH POWER LASER SYSTEMS. IN ADDITION, THE EXPERIENCE GAINED BY CONSTRUCTING AND DEMONSTRATING A PROTOTYPE SWCL SYSTEM COULD LEAD TO THE DEVELOPMENT AND COMMERCIALIZATION OF OTHER SWCL SYSTEMS FOR USE AT EVEN SHORTER WAVELENGTHS AND FOR RESEARCH ON LASER DEVICE OPTIMIZATION, CHEMICAL REACTION DYNAMICS, ETC.

APPLICATION CONFIGURED COMPUTERS INC
2580 GRAND AVE
BALDWIN, NY 11510
CONTRACT NUMBER:
THOMAS E F SOBCZAK JR
TITLE:
STRATEGIC DEFENSE COMPUTER SECURITY
TOPIC# 10 OFFICE: IDENT#: 38026

COMPUTER SECURITY IS ORIENTED TO THE MANNER IN WHICH NSA/NCSC PRECEIVES HOW A USER WILL ACT AND BEHAVE. COMPUTER HACKERS HAVE BEEN SUCCESSFUL IN INTERDICTING COMPUTING SYSTEMS BECAUSE THEY HAVE APPROACHED THE PROCESS OF COMPUTING NON-TRADITIONALLY. IN THIS REGARD, THEY BECOME INVOLVED IN ACTIONS WHICH ARE SPECIFICALLY NOT RELATED TO THE COMPUTING PROCESS, BUT WHICH AFFECT THE PROCESS, I.E.,

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THE BEST PASSWORD IS USELESS IF IT CAN BE STOLEN. THE HACKER SPENDS HIS TIME UTILIZING A STRATEGY WHICH GOES AROUND OBSTACLES. HE SEEKS BACKDOORS, TRAPDOORS, AND EGO-BASED KNOWLEDGE. IN THIS PROJECT COMPUTER SECURITY ACTIONS ARE BEING DEFINED WHICH TEND TO ASSIST A HACKER BY THEIR POMPOUSNESS. IT WILL STRUCTURE THE LOGIC BY WHICH COMMON SENSE DEFEATS PROFESSIONAL STANDARDS. WHEN SUCCESSFUL, THE POTENTIAL AND EFFECT OF ILLEGAL PROGRAMMING ACTIONS WOULD BE REDUCED IN ANY COMPUTING SYSTEM.

APPLIED SCIENCES INC (OH)
PO BOX 186 - 800 LIVERMORE ST
YELLOW SPRINGS, OH 45387

CONTRACT NUMBER:

MAX L LAKE

TITLE:

DIAMOND THIN FILMS FOR THERMIONIC FUEL ELEMENT SHEATH INSULATORS

TOPIC# 5

OFFICE:

IDENT#: 38031

FUNCTIONAL REQUIREMENTS FOR SHEATH INSULATORS ON THERMIONIC FUEL ELEMENTS (TFE) ARE THAT THE INSULATOR MUST HAVE HIGH THERMAL CONDUCTION AND LOW ELECTRICAL CONDUCTION. THE INSULATOR MUST MAINTAIN THESE CHARACTERISTICS AT AN OPERATING TEMPERATURE OF APPROXIMATELY 1000K, IN THE PRESENCE OF NEUTRON IRRADIATION OF UP TO 10^{22} n/cm² [1]. DIAMOND HAS A NUMBER OF PHYSICAL PROPERTIES, INCLUDING HIGH THERMAL CONDUCTIVITY, HARDNESS PROPERTIES, LOW THERMAL EXPANSION COEFFICIENT, RADIATION HARDNESS, HIGH BREAKDOWN FIELDS, AND GOOD OPTICAL TRANSMISSION, WHICH MAKE IT ATTRACTIVE FOR NUMEROUS APPLICATIONS. THE ABILITY TO GROW SINGLE AND POLYCRYSTAL DIAMOND FILMS ON SELECTED SUBSTRATES OFFERS THE POSSIBILITY OF USING DIAMOND FILMS AS THE SHEATH INSULATOR FOR THERMIONIC FUEL CELLS. QUESTIONS RELATING TO THIS APPLICATION ARE THE TOLERANCE OF DIAMOND FILMS TO THE OPERATING TEMPERATURE AND NEUTRON FLUX PRESENTED BY THE TFE ENVIRONMENT. IN THIS STUDY, METHODS OF COATING REFRACTORY METALS WITH DIAMOND FILM ARE BEING DEVELOPED, AND THE HARDNESS OF THESE FILMS IS BEING DETERMINED TO THE OPERATION ENVIRONMENT OF A TFE. THE ABILITY TO GROW HIGH QUALITY SINGLE AND POLYCRYSTAL DIAMOND FILMS ON SELECTED SUBSTRATES COULD LEAD TO APPLICATIONS SUCH AS THERMAL ENERGY MANAGEMENT DEVICES AND RADIATION-HARD PROTECTIVE COATINGS FOR OPTICAL ELEMENTS AND SEMICONDUCTOR DEVICES.

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APPLIED SCIENCES INC (OH)
PO BOX 186 - 800 LIVERMORE ST
YELLOW SPRINGS, OH 45387
CONTRACT NUMBER:
MAX LAKE
TITLE:
CERAMIC MATRIX COMPOSITES BY LIQUID INFILTRATION
TOPIC# 13 OFFICE: IDENT#: 38295

THIS PROJECT INVESTIGATES A PROCESS TO PRODUCE FIBER REINFORCED CERAMIC MATRIX COMPOSITES. THE COMPOSITES ARE FORMED BY INFILTRATION OF CONTINUOUS FIBER PREFORMS WITH CERTAIN LIQUIDS WHICH CAN BE CONVERTED TO A VARIETY OF REFRACTORY CARBIDE, NITRIDE, AND BORIDE CERAMICS AT LOW TEMPERATURES. THE PROCESS IS BEING DEMONSTRATED FOR ONE OF SEVERAL PROMISING SYSTEMS BY USING A HIGH PERFORMANCE VAPOR GROWN GRAPHITE FIBER INCORPORATED INTO A ZrC/ZrN CERAMIC MATRIX BY A LIQUID INFILTRATION PROCESS. THE RESULTANT COMPOSITE IS THEN FULLY CHARACTERIZED. IF SUCCESSFUL, THIS PROCESS WOULD HAVE APPLICATION IN THE MANUFACTURE OF ALL TYPES OF ENGINES, AND PARTICULARLY FOR AIRCRAFT ENGINE COMPONENTS WHERE HIGH STRENGTH AND LIGHT WEIGHT ARE REQUIRED.

APPLIED SCIENCES INC (OH)
PO BOX 186 - 800 LIVERMORE ST
YELLOW SPRINGS, OH 45387
CONTRACT NUMBER:
MAX LAKE
TITLE:
CHEMICAL VAPOR DEPOSITION/HYBRID FIBERS FOR STRUCTURAL THERMAL AND ELECTRICAL APPLICATIONS
TOPIC# 13 OFFICE: IDENT#: 38296

A NEED EXISTS FOR COMPOSITE REINFORCEMENTS WHICH HAVE ENHANCED AND COMPRESSIVE STRENGTH, WHILE RETAINING GOOD TENSILE STRENGTH AND MODULUS. THIS EFFORT EXPLORES A METHOD OF FIBER COATING WHICH ALLOWS VARYING OF THE REINFORCING FIBER DIAMETER. THE RESULT IS

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EXPECTED TO PRODUCE A COMPOSITE WITH THE DESIRED CHARACTERISTICS OF INCREASED COMPRESSIVE STRENGTH, WHILE PROVIDING A HIGHLY OXIDATION RESISTANT CARBON FINISH ON THE FIBER SURFACE. IT SHOULD ALSO INCREASE THE THERMAL AND ELECTRICAL CONDUCTIVITY OF THE CARBON FIBER TO PERMIT ITS APPLICATION IN THERMAL ENERGY MANAGEMENT SYSTEMS, "SMART" AIRCRAFT SKINS, AND ELECTRICAL COMPONENTS. THESE HIGH STRENGTH, HIGH THERMAL CONDUCTIVITY COMPOSITES HAVE NUMEROUS APPLICATIONS IN HIGH PERFORMANCE ENGINES, AEROSPACE VEHICLES, AND OTHER HIGH PERFORMANCE COMPONENTS. POTENTIAL USES INCLUDE THERMIONIC CONVERSION SYSTEMS, LIGHTWEIGHT ELECTRICAL CABLE, LIGHTWEIGHT RADAR ANTENNAS, AND ELECTROMAGNETIC SHIELDING.

ASTRO SYSTEMS INC
30 LOVETT AVE
NEWARK, DE 19711
CONTRACT NUMBER:
JAMES B McNEELY

TITLE:

THIN CRYSTALLINE INDIUM-PHOSPHIDE ON INSULATING SUBSTRATES

TOPIC# 14

OFFICE:

IDENT#: 38143

UNIFORM LARGE AREA, DEVICE QUALITY INDIUM PHOSPHIDE (InP) EPITAXIAL LAYERS ON INSULATING SUBSTRATES COULD LEAD TO THE DEVELOPMENT OF A NEW GENERATION OF PRODUCIBLE, RADIATION-HARDENED MICROELECTRONIC AND OPTOELECTRONIC INTEGRATED CIRCUITS. InP ALLOYS OFFER THE ADVANTAGES OF: PROVEN RESISTANCE TO RADIATION DAMAGE; LOWER SURFACE RECOMBINATION THAN GaAs; HIGH PEAK ELECTRON VELOCITY; AND BANDGAPS THAT MATCH THE LOW-ATTENUATION WINDOW IN SILICA-BASED OPTICAL WAVEGUIDES. IN THIS STUDY, A SIMPLE METHOD OF GROWING CRYSTALLINE InP HETEROLAYERS ON INSULATING SUBSTRATES IS BEING INVESTIGATED. THIS INVESTIGATION APPLIES SOME OF THE TECHNOLOGIES DEVELOPED IN PRODUCING GaAs/Si HETEROSTRUCTURES. THE SUCCESSFUL DEMONSTRATION OF THIS CONCEPT WILL ALLOW THE DEVELOPMENT OF RADIATION-HARD, VLSI MICROELECTRONIC COMPONENTS INCORPORATING InP-ON-INSULATOR TECHNOLOGY. APPLICATIONS FOR THIS TECHNOLOGY INCLUDE NEURAL NETWORK LOGIC AND OPTICAL INTERCONNECT/PROCESSING SCHEMES.

ASTROSYSTEMS INC
30 LOVETT AVE
NEWARK, DE 19711
CONTRACT NUMBER:
JAMES B McNEELY

TITLE:

HIGH TEMPERATURE SURVIVABLE INDIUM PHOSPHIDE SOLAR CELLS

TOPIC# 5

OFFICE:

IDENT#: 38032

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HIGH TEMPERATURE (>600 DEGREES CELSIUS) INDIUM PHOSPHIDE (InP) SPACE SOLAR CELLS ARE BEING DEVELOPED TO ELIMINATE THE PROBLEMS, SURFACE DECOMPOSITION AND CONTACT FAILURE, ENCOUNTERED WHEN InP SOLAR CELLS ARE EXPOSED TO HIGH TEMPERATURES. KEY TO THIS PROGRAM ARE THE USE OF AN ENCAPSULANT LAYER TO ARREST SURFACE DECOMPOSITION AND A HIGHLY-STABLE INTERMEDIATE DEGENERATE SEMICONDUCTOR CONTACT SYSTEM DESIGNED TO ELIMINATE CONTACT FAILURE AT HIGH TEMPERATURES. THIS METHOD IS SUPERIOR TO OTHER InP HIGH TEMPERATURE APPROACHES BECAUSE IT COMBINES EXISTING EXPERIENCE IN THE THREE TECHNICAL AREAS: PROPRIETARY ENCAPSULANT, INTERMEDIATE SEMICONDUCTOR LAYER (ISL) CONTACTS, AND A PRECISE InP SOLAR CELL MODEL. STABLE ENCAPSULATION OF InP AT 600 DEGREES CELSIUS HAS ALREADY BEEN DEMONSTRATED, AND HIGH TEMPERATURE CONTACTS TO GaAs AT 600 DEGREES CELSIUS HAS BEEN ACHIEVED USING THE INTERMEDIATE SEMICONDUCTOR LAYER APPROACH. WITH A SUITABLE SURFACE ENCAPSULANT, THE INTERMEDIATE SEMICONDUCTOR LAYER APPROACH IS EXPECTED TO LEAD TO THE BEST HIGH TEMPERATURE PERFORMANCE BECAUSE IT USES A BASE METAL LAYER WHICH FORMS A SEMICONDUCTOR RATHER THAN ALLOYING WITH THE InP. THIS PROGRAM IS EXPECTED TO RESULT IN 600 DEGREES CELSIUS SURVIVABLE InP SPACE SOLAR CELLS. HIGH TEMPERATURE PROTOTYPE InP SOLAR CELL HARDWARE ARE BEING DEMONSTRATED IN THIS PROGRAM. THE 600 DEGREES CELSIUS SURVIVABLE InP SOLAR CELL WOULD MAKE POSSIBLE NEW, HIGHER CONCENTRATION SOLAR CONCENTRATION DESIGNS FOR BOTH SPACE AND TERRESTRIAL USE. THE NATURAL RADIATION RESISTANCE OF InP WOULD MAKE THIS TECHNOLOGY THE MOST SURVIVABLE FOR SPACE POWER APPLICATION. IN ADDITION TO PHOTOVOLTAIC USE, THE ENCAPSULANT-ISL CONTACT SYSTEM WOULD HAVE BROAD APPLICATION TO OTHER InP-BASED OPTOELECTRONIC DEVICES, INCLUDING InGaAsP QUATERNARY DEVICES, LEADING TO IMPROVED SURVIVABILITY FOR THESE STRATEGIC DEVICES.

ASTROSYSTEMS INC
30 LOVETT AVE
NEWARK, DE 19711
CONTRACT NUMBER:
GERALD H NEGLEY
TITLE:

INDIUM-GALLIUM-PHOSPHIDE ON GALLIUM-PHOSPHIDE TOP SOLAR CELL
TOPIC# 5 OFFICE: IDENT#: 38033

SUBMITTED BY

AN INDIUM GALLIUM PHOSPHIDE (InGaP) ON GaP TOP SOLAR CELL IS BEING DEVELOPED FOR MECHANICAL ATTACHMENT TO AN EXISTING GaAs SOLAR CELL. THE $\text{In}_{0.27}\text{Ga}_{0.73}\text{P}$ MATERIAL IS THE LARGEST DIRECT BANDGAP MATERIAL (2.24 eV) THAT CAN BE FABRICATED ON THE TRANSPARENT GaP SUBSTRATE. HIGH QUALITY MATERIAL IS BEING GROWN BY LIQUID PHASE EPITAXY. THE InGaP IS EXPECTED TO BE A HIGH VOLTAGE, BLUE-CONVERTING SOLAR CELL TO IMPROVE THE ENERGY CONVERSION EFFICIENCY OF THE GaAs SOLAR CELL. PRESENTLY, GaAs SOLAR CELLS ARE LIMITED BY CURRENT GENERATION IN THE BLUE SPECTRUM. IT IS ANTICIPATED THAT CONVERSION EFFICIENCIES APPROACHING 30% (1X,AM) WILL BE REALIZED. THE InGaP ON GaP MAY HAVE SIMILAR RADIATION RESISTANT PROPERTIES AND LOW SURFACE RECOMBINATION VELOCITIES AS InP. THIS MATERIAL IS BEING INVESTIGATED AS A RADIATION HARD, TOP SOLAR CELL MATERIAL FOR IMPROVED CONVERSION EFFICIENCY. ENERGY CONVERSION EFFICIENCY OF A GaAs SOLAR CELL BASED SYSTEM COULD BE INCREASED BY AS MUCH AS 64% BY PLACEMENT OF AN InGaP ON GaP TOP SOLAR CELL. THE InGaP SOLAR CELL IS FABRICATED ON A RUGGED, TRANSPARENT GaP SUBSTRATE; NO SUBSTRATE THINNING OR REMOVAL OF THE SUBSTRATE IS REQUIRED. THIS PROGRAM, WHEN SUCCESSFUL, IS EXPECTED TO IMPROVE THE PERFORMANCE OF SPACE PHOTOVOLTAIC SYSTEMS. THIS TANDEM STACK COULD BE USED IN A FLAT PANEL OR CONCENTRATOR ARRAY.

AUTONOMOUS TECHNOLOGIES CORP
520 N SEMORAN BLVD - STE 180
ORLANDO, FL 32807

CONTRACT NUMBER:

CHARLIE LAYNE

TITLE:

MULTIDIMENSIONAL LADAR TRACKING AND ADAPTIVE GRASPING FOR
SPACEBORNE PLATFORM ASSEMBLY

TOPIC# 6 OFFICE: IDENT#: 38303

THIS PROJECT IS DEVELOPING A ROBOT CONTROLLER THAT DOES NOT HAVE THE LIMITATIONS OF PREVIOUS ROBOT CONTROL APPROACHES. IT USES A RECONFIGURABLE 3-D IMAGING LASER RADAR (LADAR) IN THE LOOP CONTROL ALONG WITH A PARALLEL DISTRIBUTED PROCESSING SYSTEM. THE PARALLEL TRANSPUTER DISTRIBUTED PROCESSOR CONTROLS A RECONFIGURABLE LADAR AND A STANDARD 6 DEGREES OF FREEDOM ROBOT ARM TO PROVIDE EASILY

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CONTROLLABLE GRASPING IN A SPACE ENVIRONMENT. THE SYSTEM HAS THE ABILITY TO ADAPTIVELY GRASP OBJECTS SELECTED BY A HUMAN OPERATOR. THIS REQUIRES DEVELOPMENT OF ALGORITHMS WHICH TRANSLATE THE LADAR RANGE AND INTENSITY DATA INTO GRASPING COMMANDS. THE ALGORITHMIC TASK IS BROKEN INTO SUBTASKS DISTRIBUTED AMONG THE PARALLEL PROCESSORS. THE SYSTEM HAS STRONG ADAPTABILITY THROUGH A CAD REFERENCE GENERATOR WHICH PROVIDES DATA TO CORRELATION ALGORITHMS THAT DIRECT THE ROBOT. PATH PLANNING USES SCENE SEQUENCES RATHER THAN A DEFINED OBJECT PATH DEVELOPED FROM A SINGLE FRAME ANALYSIS. THIS ALLOWS HIGH SYSTEM ADAPTABILITY TO TIME-VARIABLE SITUATIONS IN THE ROBOT ENVIRONMENT. SUCCESSFUL DEVELOPMENT OF THIS ADAPTIVE CONTROL SYSTEM CAN HAVE SIGNIFICANT UTILITY IN COMMERCIAL ROBOTICS, MANUFACTURING, AND BIO-MEDICAL APPLICATIONS.

BIOMAGNETIC TECHNOLOGIES INC
4174 SORRENTO VALLEY BLVD
SAN DIEGO, CA 92121
CONTRACT NUMBER:
WILLIAM C BLACK JR
TITLE:

LARGE ARRAY SQUID MAGNETOMETER FOR NON-DESTRUCTIVE EVALUATION
TOPIC# 15 OFFICE: IDENT#: 38857

AN IMPROVED METHOD FOR NON-DESTRUCTIVE EVALUATION (NDE) OF METALLIC STRUCTURES AND MICROCIRCUITS IS BEING DEVELOPED USING HIGH-RESOLUTION MAGNETIC SOURCE IMAGING. EXISTING NDE TECHNOLOGIES ARE NOT ALWAYS ABLE TO DETECT EARLY-STAGE METAL FATIGUE, CORROSION, OR STRESS-INDUCED FLAWS IN METALLIC STRUCTURES OR ADEQUATELY LOCALIZE FAULT CURRENTS IN VLSI AND HYBRID MICROCIRCUITS. MAGNETIC SOURCE IMAGING CAN POTENTIALLY SOLVE MEASUREMENT CAPABILITY, MUCH ENHANCED SPATIAL RESOLUTION, AND FASTER DATA ACQUISITION THAN EXISTING NDE TECHNOLOGIES. TO ACCOMPLISH THIS FOR METALLIC STRUCTURES, CURRENTS ARE INDUCED OR INJECTED INTO THE TEST SPECIMEN AND THE RESULTING MAGNETIC FIELD PATTERNS ARE MEASURED TO IDENTIFY AND CHARACTERIZE THE FLAWS. SIMILARLY, ABNORMAL CURRENT DISTRIBUTION IN VLSI AND HYBRID MICROCIRCUITS PRODUCE AN ABNORMAL MAGNETIC FIELD AROUND THE TEST STRUCTURE WHICH CAN BE MEASURED. THE EXISTENCE AND PROPERTIES OF THE FLAW CAN BE DETERMINED USING ALGORITHMS SIMILAR TO THOSE FOR IMAGING BIOMAGNETIC SOURCES. THE OBJECTIVE OF THIS EFFORT IS TO

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DEVELOP THE PERFORMANCE SPECIFICATION AND PRELIMINARY DESIGN FOR A LARGE ARRAY OF MINIATURE SQUID MAGNETIC SENSORS TO BE USED AS THE IMAGING INSTRUMENT. THIS RESEARCH MAY LEAD TO A SIGNIFICANT COMMERCIAL ROLE FOR SUPERCONDUCTING SQUID MAGNETOMETERS IN QUALITY CONTROL AND IN-SERVICE INSPECTION.

BREWER SCIENCE INC
PO BOX GG - 2401 HIGH TECH DR
ROLLA, MO 65401
CONTRACT NUMBER:

MARY G MOSS

TITLE:

HIGH RESISTIVITY SPIN-ON COATING FOR THIN FILM RESISTORS

TOPIC# 14 OFFICE: IDENT#: 38320

RECENT ADVANCES IN THE AREA OF SEMICONDUCTING POLYMERS HAVE MADE AVAILABLE A NEW CLASS OF MATERIALS WHICH HAVE CONDUCTIVITIES IN THE PROPER RANGE FOR SYNAPTIC CONNECTIONS FOR NEURAL NETWORKS. THIS STUDY WILL INVESTIGATE THIS TECHNOLOGY IN FOUR TASKS: DETERMINATION OF SPIN-COATING PARAMETERS, MEASUREMENT OF ELECTRICAL PROPERTIES, EVALUATION OF STABILITY AND REPRODUCIBILITY, AND FABRICATION AND TESTING OF SMALL-GEOMETRY RESISTORS REPRESENTING TH SYNAPTIC CONNECTIONS. THE GOAL OF THE PROJECT IS TO DETERMINE THE UTILITY OF THIS CLASS OF POLYMERS FOR NEURAL NETWORK APPLICATIONS AND TO EVALUATE THEIR PROPERTIES FOR MORE GENERAL APPLICATIONS IN MICROELECTRONICS. THE AVAILABILITY OF A STABLE AND REPRODUCIBLE MATERIAL WITH A RESISTIVITY OF ABOUT 100kohms/cm**2 IS A PROBLEM FOR NEURAL NETWORKS AS WELL AS ANY SMALL-GEOMETRY ANALOG CIRCUITRY. A SPIN-COATABLE THIN FILM RESISTIVE MATERIAL WOULD FILL A GENERAL NEED IN THE INTEGRATED CIRCUIT INDUSTRY.

BRIMROSE CORP OF AMERICA
7720 BELAIR RD
BALTIMORE, MD 21236
CONTRACT NUMBER:

DR SUDHIR B TRIVEDI

TITLE:

MICROWAVE WAVEGUIDE FABRICATION USING HIGH Tc SUPERCONDUCTORS

TOPIC# 15 OFFICE: IDENT#: 38037

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WAVEGUIDE AND CAVITY RESONATORS ARE VITAL PASSIVE COMPONENTS OF MODERN MICROWAVE COMMUNICATION SYSTEMS. TRANSMISSION LOSSES AT HIGHER FREQUENCIES GREATLY REDUCE THE EFFICIENCY OF THESE COMPONENTS. HOWEVER, RECENT ADVANCES IN HIGH T_c SUPERCONDUCTOR MATERIALS WITH ZERO DC RESISTANCE HAVE MADE VERY LOW LOSS MICROWAVE COMPONENTS POSSIBLE. THE OBJECTIVE OF THIS PROJECT IS TO FABRICATE MICROWAVE WAVEGUIDES FROM HIGH T_c SUPERCONDUCTOR MATERIALS. THIS EFFORT CONCENTRATES ON $YBaCu_3O_7$ MATERIAL, THE MOST UNDERSTOOD MATERIAL AMONG EXISTING HIGH T_c SUPERCONDUCTORS. THE SPECIFIC TASKS ON THIS PROGRAM ARE: OPTIMIZATION OF PROCESSING PARAMETERS TO OBTAIN MICRO-WAVE GRADE T_c MATERIAL, FABRICATION OF CYLINDRICAL WAVEGUIDE STRUCTURES, AND MICROWAVE CHARACTERIZATION OF THESE WAVEGUIDE STRUCTURES. SUCCESSFUL DEVELOPMENT OF LOW LOSS MICROWAVE WAVEGUIDES COULD SIGNIFICANTLY IMPROVE THE RANGE AND SIGNAL QUALITY OF MILITARY AND COMMERCIAL MICROWAVE SYSTEMS.

BRIMROSE CORP OF AMERICA

7720 BELAIR RD

BALTIMORE, MD 21236

CONTRACT NUMBER:

J I SOOS

TITLE:

PICO-SECOND OPTICAL HARDWARE IMPLEMENTATION FOR NEURAL NETWORK SYSTEMS

TOPIC# 11

OFFICE:

IDENT#: 38038

ACOUSTO-OPTIC (AO) BRAGG CELLS OFFER THE ADVANTAGES OF RELATIVELY LOW POWER CONSUMPTION AND THE ABILITY TO PRODUCE MULTIPLE OUTPUT OPTICAL BEAMS OF VARYING INTENSITY FOR ONE BEAM ENTERING THE SYSTEM. THE MAJOR DISADVANTAGE OF THE AO DEVICE IS ITS ACOUSTIC WAVEFORM PROPAGATION DELAY, WHICH SETS A FUNDAMENTAL LIMIT ON DEVICE SPEED. ELECTRO-OPTIC (EO) DEVICES, ON THE OTHER HAND, OFFER AN ORDER OF MAGNITUDE GREATER SPEED (30 GHz), BUT REQUIRE HIGHER POWER AND CAN ONLY ADJUST THE INTENSITY OF THE OUTPUT BEAM. IN THIS STUDY, A CONCEPT FOR COMBINING THE ADVANTAGES OF EACH DEVICE INTO AN ACOUSTO-ELECTRO-OPTIC (AEO) DEVICE FOR USE IN A NEURAL NETWORK SYSTEM WILL BE INVESTIGATED. THE COMBINATION OF AO AND EO TECHNOLOGIES IS EXPECTED TO PRODUCE A DEVICE CAPABLE OF 30 GHz

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MODULATION OF MULTIPLE BEAMS WITH MODEST POWER CONSUMPTION.
SUCCESSFUL DEMONSTRATION OF THIS TECHNOLOGY WOULD PROVIDE PICO-SECOND,
OPTIC-ELECTRONIC DEVICES FOR MILITARY AND COMMERCIAL NEURAL NETWORK
APPLICATIONS.

CHRONOS RESEARCH LABS INC
4186 SORRENTO VALLEY BLVD - STE H
SAN DIEGO, CA 92121
CONTRACT NUMBER:
DR RANDALL B OLSEN
TITLE:
ADVANCED NON-NUCLEAR SPACE POWER SYSTEM
TOPIC# 5 OFFICE: IDENT#: 38159

RECENT ADVANCES IN PYROELECTRICS HAVE PROVIDED MATERIALS WHICH MAY
BE USEFUL IN THE DIRECT CONVERSION OF HEAT INTO ELECTRICAL ENERGY
IN SPACE SYSTEMS. THESE MATERIALS ARE EXPECTED TO BE MANUFACTURED
AT LOW COST AND PROVIDE AN ULTRA-LIGHTWEIGHT MEANS OF GENERATING
ELECTRICAL POWER FROM A SYSTEM WITH NO MOVING SOLID PARTS. A
RELATIVELY NEW TECHNOLOGY, PYROELECTRIC CONVERSION HAS THE POTENTIAL
FOR HIGH RELIABILITY AND EFFICIENCY. IN THIS EFFORT, THE USEFUL
LIFETIME OF A HIGH FLUORINE CONTENT PYROELECTRIC POLYMER IS BEING
MEASURED. THE PROPERTIES OF THIS ADVANCED MATERIAL ARE BEING
FOLLOWED FOR EXTENDED TIME PERIODS AS IT IS SUBJECTED TO THE THERMAL
AND ELECTRICAL CYCLING CONDITIONS WHICH WILL EXIST IN PYROELECTRIC
ENERGY CONVERTERS. IN ADDITION TO SPACE POWER SYSTEMS, PYROELECTRIC
CONVERTERS ARE EXPECTED TO ECONOMICALLY CONVERT LOW TEMPERATURE
HEAT INTO ELECTRICAL ENERGY TERRESTRIAL SYSTEMS (CAPITAL COST LESS
THAN ONE DOLLAR PER WATT).

CLEVELAND CRYSTALS INC
19306 REDWOOD AVE
CLEVELAND, OH 44110
CONTRACT NUMBER:
GARY CATELLA
TITLE:
BETA-BARIUM BORATE GROWTH AND TESTING
TOPIC# 3 OFFICE: IDENT#: 38332

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BETA-BARIUM BORATE (BBO) IS BEING INVESTIGATED AS A PROMISING NONLINEAR OPTICAL MATERIAL, SUITABLE FOR OPTICAL PARAMETRIC OSCILLATORS (OPO). BBO OPO'S COULD PROVIDE THE MEANS TO PRODUCE A CONTINUUM OF BROADLY TUNABLE RADIATION FROM THE ULTRAVIOLET (UV) INTO THE INFRARED (IR). SIGNIFICANT PROGRESS IN ITS MATERIAL CHARACTERIZATION AND DEMONSTRATED OPO PERFORMANCE HAVE BEEN ACCOMPLISHED. BBO IS EXPECTED TO BE AN EXCELLENT MATERIAL FOR BROADBAND SENSOR APPLICATIONS. 0.226 MICROSECOND PUMPED BBO OPO, WITH A BBO SECOND HARMONIC GENERATOR (SHG), SHOULD THEORETICALLY COVER THE WAVELENGTH RANGE FROM APPROXIMATELY 0.2 TO 3.0 MICROSECONDS. A BBO OPO DRIVEN BY A DIODE-LASER PUMPED SOLID-STATE LASER SYSTEM, WOULD FORM THE BASIS FOR AN EFFICIENT, LIGHTWEIGHT, COMPACT, SPACE-BASED LASER SYSTEM. WHILE BBO HAS EXCELLENT NONLINEAR AND LINEAR OPTICAL PROPERTIES, IT IS RELATIVELY UNDEVELOPED AT PRESENT. IN THIS PRIMARILY GROWTH DEVELOPMENT EFFORT, CONCENTRATION IS ON INTENSIVE QUALITY SINGLE CRYSTAL GROWTH. THIS GROWTH EFFORT WOULD BE EXTENDED INTO FURTHER RESEARCH, WHICH WOULD ALSO DEMONSTRATE THE FEASIBILITY OF AN INTERMEDIATE POWER OPO BASED ON BBO. THE BBO OPO, AS A SOURCE OF INTERMEDIATE POWER, FREQUENCY AGILE, LASER RADIATION IN THE NEAR IR, VIS AND UV, WOULD BE USEFUL FOR MANY LASER APPLICATIONS IN THE FIELDS OF REMOTE LASER INDUCED EMISSION SPECTROSCOPY MEDICINE, MATERIALS PROCESSING, NONLINEAR OPTICS, LIDAR, REMOTE SENSING AND PHOTOCHEMISTRY. COMMERCIALY, IT WOULD BE COMPETITIVE WITH DYE LASERS AND TUNE OVER LARGER FREQUENCY RANGES.

COHERENT TECHNOLOGIES INC

PO BOX 7488

BOULDER, CO 80306

CONTRACT NUMBER:

SAMMY HENDERSON

TITLE:

NARROW-BAND DIODE LASER-PUMPED TRANSMITTER FOR PULSED COHERENT LASER RADAR SYSTEMS

TOPIC# 3 OFFICE:

IDENT#: 38334

MANY TACTICAL AND STRATEGIC REMOTE SENSING APPLICATIONS WOULD BENEFIT FROM A NARROW-BAND EFFICIENT EYESAFE SOLID-STATE LASER SOURCE. RECENT PROGRESS IN DIODE LASER-PUMPING OF THULIUM (TM)- AND Tm:HOLIUM

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(Ho)-DOPED SOLID-STATE LASERS HAS DEMONSTRATED THAT LOW POWER CONTINUOUS WAVE (CW) DEVICES CAN OPERATE AT OR NEAR ROOM TEMPERATURE VERY EFFICIENTLY. ANALYSIS INDICATES THESE LASERS COULD ALSO WORK WELL UNDER Q-SWITCHED OPERATION AT ROOM TEMPERATURE. AT THIS TIME, DEMONSTRATIONS OF Q-SWITCHING THESE MATERIALS UNDER DIODE-LASER-PUMPING HAVE NOT BEEN REPORTED. IN THIS INVESTIGATION, ANALYSIS AND EXPERIMENTS ARE BEING PERFORMED TO PROVE FEASIBILITY FOR THE DEVELOPMENT OF A PRACTICAL 10 mJ/PULSE 200-HZ DIODE LASER-PUMPED Q-SWITCHED Tm:YAG OR TmHo:YAG LASER OPERATING AT ROOM TEMPERATURE OR COOLED SLIGHTLY BELOW ROOM TEMPERATURE USING THERMOELECTRIC COOLERS. THE FEASIBILITY EXPERIMENTS INCLUDE A MATERIALS OPTIMIZATION PROGRAM IN WHICH THE Q-SWITCHED PERFORMANCE OF SEVERAL Tm:YAG AND Tm:Ho:YAG CRYSTALS WITH VARYING Tm AND Ho CONCENTRATIONS ARE BEING COMPARED. NUMEROUS FEDERAL, COMMERCIAL, AND SCIENTIFIC APPLICATIONS EXIST FOR AN EFFICIENT, COMPACT EYESAFE LASER. THE LONG UNATTENDED LIFETIME AND ENERGY EFFICIENCY OF A DIODE-PUMPED, PULSED COHERENT LASER RADAR WOULD BE OF GREAT INTEREST TO RESEARCHERS IN TACTICAL AND STRATEGIC DEFENSE APPLICATIONS, METEOROLOGY, AND POLLUTION MONITORING. A MAJOR APPLICATION FOR THIS TECHNOLOGY IS FOUND IN REAL-TIME, ON-BOARD AIRLINER WIND SHEAR AND TURBULENCE AVOIDANCE SYSTEMS.

COHERENT TECHNOLOGIES INC

PO BOX 7488

BOULDER, CO 80306

CONTRACT NUMBER:

SAMMY HENDERSON

TITLE:

SOLID-STATE MULTIPLE-PASS AMPLIFIER FOR DIODE PUMPED COHERENT LASER RADAR SYSTEMS

TOPIC# 3

OFFICE:

IDENT#: 38335

SOLID-STATE LASER SYSTEMS HAVE BEEN IDENTIFIED AS A PARTICULARLY EFFECTIVE TRANSMITTER TECHNOLOGY FOR USE IN COHERENT LASER RADAR SYSTEMS, DUE TO THEIR NEAR-IR WAVELENGTH (1-2um), COMPACTNESS, FREQUENCY AGILITY, AND EFFICIENCY. RECENT ADVANCES IN LASER DIODE ARRAY TECHNOLOGY HAVE OPENED NEW PROSPECTS FOR LONG LIFE, HIGH ENERGY AND AVERAGE POWER SOLID-STATE LASER RADAR INSTRUMENTS SUITABLE FOR EXTENDED, UNATTENDED USE IN SPACE. IN THIS STUDY, THE Nd:YAG MASTER OSCILLATOR, POWER AMPLIFIER (MOPA) LASER RADAR CONFIGURATION

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HAS BEEN SELECTED AS THE "BEST FORM" SYSTEM FOR STRATEGIC APPLICATIONS. FEASIBILITY OF A MOPA MULTIPLE-PASS SLAB AMPLIFIER WITH THE REQUIRED SPECIFICATIONS IS BEING INVESTIGATED: DIFFRACTION-LIMITED OPTICAL PERFORMANCE, EFFICIENT DIODE-ARRAY PUMPED OPERATION, AND HIGH AVERAGE POWER CAPABILITY. THE STEPS TO ACHIEVING THIS GOAL FIRST INVOLVE THE SPECIFICATION AND PROCUREMENT OF A HIGH PERFORMANCE MINIATURE Nd:YAG AMPLIFIER SLAB CAPABLE OF VERY LOW DISTORTION OPERATION. ONCE FABRICATED, THE HIGH PERFORMANCE SLAB WILL BE FULLY CHARACTERIZED IN AN EXISTING FLASHLAMP-PUMPED MULTIPLE-PASS AMPLIFIER TEST FIXTURE TO PROVIDE DATA NECESSARY FOR THE OPTIMIZATION OF AN ALL-SOLID-STATE SLAB AMPLIFIER. DESIGN AND DEVELOPMENT OF THE DIODE-PUMPED VERSION IS BEING INITIATED WITH A GOAL OF PROVIDING A SOLID FOUNDATION FOR THE FULLY DIODE-PUMPED AMPLIFIER DEVELOPMENT IN LATER RESEARCH. THE DEVELOPMENT OF AN ALL-SOLID-STATE COHERENT LASER RADAR SYSTEM IS A VITAL LINK IN THE CHAIN OF TECHNOLOGIES REQUIRED FOR STRATEGIC DEFENSE AND TARGET RECOGNITION APPLICATIONS. A MULTIPLE-PASS, VERY HIGH GAIN SLAB AMPLIFIER HAVING DIFFRACTION-LIMITED PERFORMANCE MUST BE DEVELOPED TO ACHIEVE THIS GOAL IN THE NEAR TERM. COMMERCIAL AND RESEARCH APPLICATIONS FOR A HIGH PERFORMANCE SLAB AMPLIFIER INCLUDE SPECTROSCOPY, COMMUNICATIONS, AND METEOROLOGICAL RESEARCH. TECHNOLOGY DEVELOPED IN THIS EFFORT WOULD ALSO BE APPLICABLE TO EYESAFE AND BROADLY TUNABLE SOLID-STATE MATERIALS.

COLORADO SUPERCONDUCTOR INC
55 SPINDRIFT CT
FORT COLLINS, CO 80525
CONTRACT NUMBER:
DR DAVID J LEARY

TITLE:
MULTICOMPONENT COMPOSITE CERAMIC SUPERCONDUCTING TAPE CONDUCTOR
TOPIC# 15 OFFICE: IDENT#: 38048

HIGH T_c CERAMIC SUPERCONDUCTORS OFFER THE POTENTIAL OF REDUCED LOSSES IN LARGE SCALE CONDUCTORS COMPARED TO CONVENTIONAL METALS, AND THE ECONOMY OF 77 K REFRIGERATION COMPARED TO LOW T_c SUPERCONDUCTORS. THIS EFFORT DEMONSTRATES THE FEASIBILITY TO TAPE CONDUCTORS FABRICATED FROM THE CONTRACTORS' HTSC LAMINATE. THIS TAPE IS FORMED USING A LOW COST BULK PROCESSING METHOD ACHIEVING >3000 A/cm². TAPE

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CONDUCTORS ARE FABRICATED FROM THE LAMINATE WHICH COMPRISE A COMPOSITE CERAMIC SUPERCONDUCTOR LAYER ON A SUPERALLOY STEEL FOIL SUBSTRATE AND A SINGLE CLADDING LAYER. FLEXIBLE HTSC TAPE CONDUCTORS WITH SIGNIFICANTLY IMPROVED MECHANICAL STRENGTH, CHEMICAL AND MECHANICAL STABILITY. DEFENSE AND COMMERCIAL TAPE APPLICATIONS INCLUDE POWER TAPS THROUGH CRYOGENIC VESSELS (E.G., SMES LEADS), WINDINGS IN GENERATORS, MOTORS, TRANSFORMERS, HIGH FIELD MAGNETS AND MAGNETIC ENERGY STORAGE SYSTEMS, AND COAXIAL POWER TRANSMISSION CABLE.

CORIOLIS CORP
15315 SOBEY RD
SARATOGA, CA 95070
CONTRACT NUMBER:
ARTHUR H IVERSEN
TITLE:
THERMAL MANAGEMENT OF HIGH HEAT FLUX ELECTRONIC COMPONENTS
TOPIC# 7 OFFICE: IDENT#: 38052

INVENTION OF A NEW CLASS OF HEAT TRANSFER SURFACES PERMITS EFFICIENT THERMAL MANAGEMENT OF HIGH HEAT FLUX ELECTRONIC COMPONENTS IN SPACE AND AIRCRAFT SYSTEMS. ADVANTAGES INCLUDE HEAT TRANSFER UNAFFECTED BY ZERO "GEE" (STATIONARY) AND HIGH "GEE" (MANEUVERING) SPACE PLATFORMS AND AIRCRAFT. THIS COULD BE ACHIEVED BY EMPLOYING CURVED SURFACE COOLING USING SUB-COOLED NUCLEATE BOILING COMBINED WITH A GENERAL PURPOSE ELECTRONIC COMPONENT HEAT SINK STRUCTURE THAT ALSO OFFERS RUGGEDNESS, INHERENT LOW THERMAL RESISTANCE, HIGH PACKING DENSITY, HIGH VOLUMETRIC HEAT DENSITY, HERMETIC SEALING, AND IS COST EFFECTIVE. IN A PRIOR EXPERIMENT, CURVED SURFACE COOLING DEMONSTRATED HEAT DISSIPATION OF 6 KW/cm². WHEN APPLIED TO SEMI-CONDUCTORS AND DERATED TO THE MAXIMUM HEAT FLUX ANTICIPATED BY 1990, E.G. 100 W/cm² FOR I.C.'S, CONSERVATIVE AND RELIABLE OPERATION COULD BE EXPECTED. WITH KW/cm² DISSIPATION, LOW BOILING POINT COOLANTS, AND LOW CHIP-SUBSTRATE DIFFERENTIAL EXPANSION, PACKAGING NEEDS, EXTENDING TO WAFER SCALE MAY BE SATISFIED WELL INTO THE NEXT CENTURY. IN THIS PROGRAM, A BROADBAND CURVED SURFACE SEMI-CONDUCTOR HIGH HEAT FLUX HEAT SINK IS BEING DESIGNED, FABRICATED AND TESTED. A CHIP WITH HEATING ELEMENTS FOR FLUXES APPROACHING 100 K/cm² AND DIODES FOR TEMPERATURE MEASUREMENT IS BEING USED. HEAT FLUX VERSUS DIODE

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TEMPERATURE TESTS ARE BEING CONDUCTED TO DEMONSTRATE LOW JUNCTION TEMPERATURE RISE () AT HIGH HEAT FLUXES. WHEN SUCCESSFUL, APPLICATION FOR FUTURE VERY HIGH SPEED INTEGRATED CIRCUIT (VHSIC) AND COMMERCIAL VERY LARGE SCALE INTEGRATION (VLSI) COMPUTER IS ANTICIPATED.

CORIUM INDUSTRIES INC
602 COUNTRY FAIR DR
CHAMPAIGN, IL 61821

CONTRACT NUMBER:

DR HAN-RYONG PAK

TITLE:

AUTOMATED ION BEAM SPUTTER DEPOSITION SYSTEM FOR HIGH TEMPERATURE SUPERCONDUCTING PATTERN PRODUCTION

TOPIC# 15

OFFICE:

IDENT#: 38337

TWO IMPORTANT APPLICATIONS OF HIGH TEMPERATURE SUPERCONDUCTORS ARE SUPERCONDUCTING INTERCONNECTS FOR HYBRID SEMICONDUCTOR/SUPERCONDUCTOR DEVICES; AND VERY FAST SUPERCONDUCTING SWITCHES FOR JOSEPHSON JUNCTION DEVICES. HOWEVER MAJOR IMPROVEMENTS MUST BE MADE IN PRESENT THIN-FILM TECHNOLOGY BEFORE SUPERCONDUCTING MICROCIRCUITS ARE PRACTICAL. THIS EFFORT DEVELOPS AND DEMONSTRATES AN INTEGRATED SYSTEM FOR AUTOMATED IN-SITU SPUTTER DEPOSITION AND PROCESSING OF HIGH CRITICAL TEMPERATURE SUPERCONDUCTING THIN FILMS. THIS SYSTEM IS DESIGNED TO ELIMINATE MANY OF THE SOURCES OF IRREPRODUCIBILITY AND IS ESPECIALLY WELL SUITED TO THE DESPOSITION OF MULTICOMPONENT METAL OXIDE THIN FILMS. THIS SYSTEM ALSO ALLOWS THE USE OF FOCUSED ELECTRON, ATOM, AND ION BEAM SOURCES DURING BOTH THIN FILM DEPOSITION AND AS A POST-PROCESSING STEP. THE ABILITY TO PRODUCE SUPERCONDUCTING INTERCONNECTS IS REQUIRED FOR THE DEVELOPMENT OF HYBRID SEMICONDUCTOR/SUPERCONDUCTOR DEVICES. THESE HYBRID DEVICES WILL BECOME EXTREMELY IMPORTANT AS APPLICATIONS. OTHER APPLICATIONS INCLUDE SQUIDS AND JOSEPHSON JUNCTION DEVICES.

CREARE INC
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HANOVER, NH 03755
CONTRACT NUMBER:
DR MICHAEL G IZENSON
TITLE:

SLUSH HYDROGEN PROPELLANT PRODUCTION AND STORAGE

TOPIC# 6

OFFICE:

IDENT#: 38059

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HIGH DENSITY SLUSH HYDROGEN PROPELLANT CAN GREATLY REDUCE THE COST OF REACHING SPACE BY ENABLING HYPERSONIC AEROSPACE VEHICLES TO FLY TO ORBIT AND BACK IN A SINGLE STAGE. SLUSH HYDROGEN IS A FAVORED PROPELLANT FOR THESE SPACE PLANES BECAUSE IT PROMISES SIGNIFICANT SIZE AND MASS REDUCTIONS COMPARED TO LIQUID HYDROGEN. HOWEVER, TECHNOLOGY FOR LARGE-SCALE PRODUCTION AND STORAGE OF SLUSH HYDROGEN HAS NOT YET BEEN DEVELOPED. A DEVICE FOR LARGE SCALE PRODUCTION AND MANAGEMENT OF SLUSH IS BEING INVESTIGATED. WHEN SUCCESSFUL, THIS DEVICE WOULD REDUCE LAUNCH SYSTEM COSTS FOR SPACE PLANES COMPARED TO CONVENTIONAL TECHNIQUES BY GREATLY SIMPLIFYING THE PRODUCTION AND STORAGE SYSTEM, IMPROVING THE SAFETY OF GROUND OPERATIONS AND ENHANCING SYSTEM RELIABILITY. THE PRIMARY APPLICATIONS WOULD BE LOW COST PRODUCTION, STORAGE AND CONTROL OF SLUSH HYDROGEN PROPELLANT FOR SINGLE-STAGE TO ORBIT VEHICLES SUCH AS THE X-30 NATIONAL AEROSPACE PLANE. OTHER APPLICATIONS OF SLUSH CRYOGENS SUCH AS COLD STORAGE COULD ALSO BENEFIT FROM THIS PROJECT.

CREARE INC
PO BOX 71
HANOVER, NH 03755
CONTRACT NUMBER:
WALTER L SWIFT
TITLE:
MINIATURE HIGH-EFFECTIVENESS HEAT EXCHANGERS FOR SPACE-BORNE
SENSOR COOLING
TOPIC# 3 OFFICE: IDENT#: 38074

THE PERFORMANCE OF SPACEBORNE SENSORS AND CRYCOOLERS IS STRONGLY INFLUENCED BY THE COLD PLATE/HEAT EXCHANGER WHICH FORMS THE SENSOR/COOLING SYSTEM INTERFACE. IN THIS STUDY, A HIGH PERFORMANCE HEAT EXCHANGER IS BEING INVESTIGATED FOR SPACEBORNE SENSORS COOLED BY GAS CYCLE CRYCOOLERS. THE OBJECTIVE IS TO OPTIMIZE THE HEAT EXCHANGER WITH RESPECT TO SENSOR REQUIREMENTS AND CYCLE PERFORMANCE. THE HIGH EFFECTIVENESS, MINIATURE HEAT EXCHANGER IS EXPECTED TO MAINTAIN A UNIFORM COLD PLATE TEMPERATURE AND SIGNIFICANTLY REDUCE CYCLE INPUT POWER REQUIREMENTS COMPARED TO A CONVENTIONAL COMPACT HEAT EXCHANGER, ESPECIALLY UNDER SMALL SIZE CONSTRAINTS. FABRICATION METHODS TO ACHIEVE HIGH EFFECTIVENESS IN SMALL SIZES ARE BEING

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EMPLOYED. TRADES AND ANALYSIS ARE BEING PERFORMED TO DEFINE AN OPTIMAL HEAT EXCHANGER CONFIGURATION FOR UP TO THREE DIFFERENT SENSOR COOLING APPLICATIONS. FABRICATION TECHNIQUES ARE BEING DEMONSTRATED FOR EACH CONCEPT. AT A LATER EFFORT, ONE OR MORE PROTOTYPE HEAT EXCHANGERS WILL BE FABRICATED AND TESTED FOR INTEGRATION WITH A SENSOR AND CRYOCOOLER. WHEN SUCCESSFUL, SUBSTANTIAL WIGHT REDUCTION WOULD OCCUR FOR SENSOR COOLING SYSTEMS DUE TO HIGH HEAT EXCHANGER EFFECTIVENESS. SENSOR PERFORMANCE WOULD ALSO BENEFIT AS A RESULT OF UNIFORM COLD PLATE TEMPERATURE. ADDITIONALLY, THE FABRICATION METHODS DEVELOPED COULD BE USED TO PRODUCE HIGH PERFORMANCE COLD PLATES IN OTHER ELECTRONIC COOLING APPLICATIONS WHERE COMPACTNESS, HIGH EFFECTIVENESS AND TEMPERATURE UNIFORMITY ARE CRITICAL.

CRYO-POWER ASSOCS
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LOS ALAMOS, NM 87544
CONTRACT NUMBER:
HENRY L LAQUER
TITLE:

HIGH TEMPERATURE SUPERCONDUCTORS WITH IMPROVED CURRENT DENSITIES
TOPIC# 15 OFFICE: IDENT#: 38356

THE APPLICATION OF HIGH TEMPERATURE SUPERCONDUCTORS IS SEVERELY LIMITED BY THE LOW CURRENT DENSITIES ACHIEVABLE IN BULK MATERIALS, SUCH AS $YBa_2Cu_3O_{7-x}$, OR 123 FOR SHORT. THE LARGE CURRENT DENSITIES OBSERVED WITHIN INDIVIDUAL GRAINS (AND IN THIN FILMS) ARE REDUCED BY "WEAK LINKS" AT THE GRAIN BOUNDARIES, CAUSED BY MISALIGNMENT OF THE ANISOTROPIC GRAINS AND BY INSULATING IMPURITY PHASES. SOME OF THE IMPURITIES COME FROM THE DECOMPOSITION OF THE THERMODYNAMICALLY UNSTABLE 123 ABOVE 450C. TASK ONE HAS BEEN TO MANUFACTURE AND CHARACTERIZE THE MUCH MORE STABLE 124 COMPOUND, PHASE-PURE AND IN COMMERCIAL LOTS. TASK TWO IS TO HOT DEFORM AND TEXTURE THIS MATERIAL AT CONTROLLED OXYGEN PRESSURES BETWEEN 700 AND 1000C AND THEREBY TAKE ADVANTAGE OF THE ANISOTROPY. THE OBJECTIVE IS TO DEMONSTRATE THAT THE RELATIVELY SMALL DEFORMATIONS REQUIRED TO IMPROVE CURRENT DENSITIES ARE COMPATIBLE WITH THE MANUFACTURE OF SIMPLE CYLINDRICAL SHAPES. SUCH SHAPES COULD HAVE IMMEDIATE MILITARY AND COMMERCIAL USES IN EMP SHIELDS, HIGH FIELD MAGNETS, MOTORS, MAGNETIC BEARINGS, AND LEVITATED TRAINS.

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CRYSTALLUME
125 CONSTITUTION DR
MENLO PARK, CA 94025
CONTRACT NUMBER:
DR K V RAVI
TITLE:
CHEMICAL VAPOR DEPOSITION DIAMOND FILMS FOR TRIBOLOGICAL
APPLICATIONS
TOPIC# 13 OFFICE: IDENT#: 38060

THE ABILITY TO DEPOSIT HIGH QUALITY DIAMOND FILMS USING PLASMA
ENHANCED CHEMICAL VAPOR DEPOSITION (CVD) OFFERS THE OPPORTUNITY TO
SIGNIFICANTLY ENHANCE THE TRIBOLOGICAL CHARACTERISTICS OF MATERIALS.
IN THIS PROGRAM, TECHNOLOGIES FOR DEPOSITING DIAMOND THIN FILMS WITH
A VARIETY OF MICROSTRUCTURAL AND CHEMICAL CHARACTERISTICS ARE BEING
DEVELOPED. THESE FILMS WILL BE TESTED TO INVESTIGATE SOME OF THE
KEY STRUCTURAL PROPERTIES OF DIAMOND FILMS THAT INFLUENCE THEIR
FRICTION COEFFICIENTS AND WEAR BEHAVIOR. AN APPROACH FOR REDUCING
THE FRICTION COEFFICIENT OF THE FILMS IS ALSO BEING TESTED. THE
FILMS ARE BEING DEPOSITED ON BOTH SINGLE CRYSTAL SILICON AND ON
POLYCRYSTALLINE SILICON CARBIDE. DIAMOND DEPOSITION ON SILICON
CARBIDE PROVIDES THE NEEDED DATA FOR SUBSEQUENT DIAMOND COATING OF
SILICON CARBIDE BEARINGS. COMMERCIAL APPLICATIONS OF HARD DIAMOND
FILM COATINGS INCLUDE TOOLS SUCH AS INSERTS, DRILLS, PUNCHES,
NOZZLES; WEAR SURFACES IN INDUSTRIAL PROCESS CONTROL EQUIPMENT; AND
AUTOMOTIVE AND AIRCRAFT APPLICATIONS.

CRYSTALLUME
125 CONSTITUTION DR
MENLO PARK, CA 94025
CONTRACT NUMBER:
DR K V RAVI
TITLE:
POLYCRYSTALLINE DIAMOND JUNCTION FIELD EFFECT TRANSISTORS
TOPIC# 14 OFFICE: IDENT#: 38343

THIS PROJECT WILL INVESTIGATE THE FEASIBILITY OF AN ALL DIAMOND

SUBMITTED BY

JUNCTION FIELD EFFECT TRANSISTOR (JFET). THIS DEVICE; CONSTRUCTED FROM LARGE GRAIN (5-20 MICRONS) DOPED CVD DIAMOND FILMS, INCORPORATES GRAIN BOUNDARY PASSIVATION WITHIN THE ACTIVE CHANNEL REGION. CURRENT FLOW IN THE JFET IS CONFINED TO SINGLE CRYSTAL REGIONS IN THE POLYCRYSTALLINE FILMS, WHICH ELIMINATES THE IMPACT OF GRAIN BOUNDARY SCATTERING ON DEVICE SPEED. A DIAMOND JFET WILL HAVE A BUILT-IN VOLTAGE OF APPROXIMATELY 4.0 VOLTS AND IS WELL MATCHED TO THE BANDGAP OF DIAMOND, WHICH ALLOWS VERY HIGH TEMPERATURE OPERATION. IN THE PROPOSED DEVICE CONFIGURATION AN N+ DIAMOND GATE AS A GATE INSULATOR ALLOWING LARGE VOLTAGE SWINGS OF EITHER POLARITY WITHOUT CONDUCTING SIGNIFICANT CURRENT. THE NITROGEN DOPED GATE LAYER FUNCTIONS AS BOTH GRAIN BOUNDARY AND DEVICE PASSIVATION LAYER. THE HIGH RADIATION RESISTANCE, REDUCED COOLING REQUIREMENTS, AND POTENTIAL OF ACHIEVING THE HIGHEST SPEED OPERATION OF ANY POTENTIAL SEMICONDUCTOR SYSTEM MAKES THIS TECHNOLOGY OF INTEREST FOR A VARIETY OF DEFENSE AND COMMERCIAL APPLICATIONS.

CSA ENGINEERING INC
560 SAN ANTONIO RD - STE 101
PALO ALTO, CA 94306
CONTRACT NUMBER:
DR DAVID A KIENHOLZ
TITLE:
VIBRATION ISOLATION SYSTEM
TOPIC# 1 OFFICE: IDENT#: 38062

LABORATORY POINTING AND TRACKING EXPERIMENTS FREQUENTLY REQUIRE A HIGH DEGREE OF ISOLATION FROM BACKGROUND VIBRATION, SOMETIMES EXCEEDING THE CURRENT STATE-OF-THE-ART. A NEW ISOLATION CONCEPT IS BEING INVESTIGATED. BASED ON RECENT DEVELOPMENTS IN SUSPENSION SYSTEMS FOR SIMULATING ON-ORBIT CONDITIONS WITH LARGE SPACE STRUCTURES, THE INNOVATIVE METHOD IS THEORETICALLY CAPABLE OF ORDER-OF-MAGNITUDE IMPROVEMENTS RELATIVE TO CURRENT TECHNOLOGY. IN THIS RESEARCH PHASE, A SINGLE SUSPENSION DEVICE IS BEING DEVELOPED AS THE BASIS OF AN ULTRAQUIET PLATFORM. A SET OF FOUR SUCH DEVICES WOULD SUPPORT AN INTEGRALLY DAMPED PLATFORM WITH A PAYLOAD AS MUCH AS SEVERAL THOUSAND POUNDS. AN IMPORTANT COMMERCIAL APPLICATION IS IN INTEGRATED CIRCUIT MANUFACTURING WHERE SUB-MICRON FEATURE SIZE HAS MADE VIBRATION ISOLATION A CRITICAL ISSUE IN WAFER STEPPERS,

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OPTICAL INSPECTION SYSTEMS, AND OTHER CHIP PRODUCTION MACHINES.

DAYHOFF J & ASSOCS INC
2685 MARINE WY - STE 1220
MOUNTAIN VIEW, CA 94043
CONTRACT NUMBER:
DR JUDITH E DAYHOFF
TITLE:
PULSE SUPERPOSED NEURAL NETWORKS FOR PATTERN ANALYSIS RESEARCH
TOPIC# 10 OFFICE: IDENT#: 38425

NEURAL NETWORK TECHNOLOGY APPEARS PROMISING FOR MANY APPLICATIONS, INCLUDING SIGNAL PROCESSING, IMAGE ANALYSIS, SPEECH RECOGNITION, PATTERN RECOGNITION, AND KNOWLEDGE PROCESSING. ALTHOUGH A VARIETY OF PARADIGMS HAVE BEEN STUDIED, THE NEURAL NETWORK PARADIGMS IN USE CURRENTLY ARE LIMITED TO THOSE WITH NO SPECIFIC TEMPORAL STRUCTURE IN THE INTERCONNECTIONS BETWEEN NEURONS. SUPERIMPOSING A PULSE TRANSMISSION STRUCTURE IN THE INTERCONNECTIONS BETWEEN NEURONS PROVIDES A TEMPORAL STRUCTURE IN THOSE INTERCONNECTIONS. IN THIS STUDY, PULSE SUPERPOSITION ON NEURAL NET PARADIGMS IS BEING INVESTIGATED. SPECIAL EMPHASIS IS BEING GIVEN TO EVALUATE THE LIMITATION OF CURRENT NEURAL NET PARADIGMS IN SOLVING PROBLEMS THAT INVOLVE TEMPORALLY VARYING INPUTS AND OUTPUTS. THE ISSUE OF WHETHER ANY INCREASED CAPABILITIES RESULT FROM PULSE SUPERPOSITION IS BEING EXAMINED. ANY IMPLEMENTATION ADVANTAGES IN BUILDING MASSIVELY PARALLEL SYSTEMS USING PULSE TRANSMISSIONS IS BEING EXAMINED. MODEL STRUCTURES ARE BEING IDENTIFIED THAT MAY BE USEFUL FOR APPLICATIONS, AND THEIR FEASIBILITY IS BEING DETERMINED. EMPHASIS IS BEING GIVEN TO POTENTIAL APPLICATIONS IN THE CLASSIFICATION AND SYNTHESIS OF TEMPORALLY VARYING PATTERNS, SUCH AS SPEECH SIGNALS AND MOVING IMAGES. AN EXTENSIVE SIMULATION STUDY ON PULSE SUPERPOSITION NEURAL NETWORKS IS ALSO BEING PERFORMED. WHEN SUCCESSFUL, ANTICIPATED BENEFITS INCLUDE ARTIFICIAL NEURAL NETWORK SIMULATORS; SYSTEMS THAT INVOLVE ANALYSIS OF TIME-VARYING DATA; SPEECH ANALYSIS SYSTEMS; COMMUNICATIONS SYSTEMS; AND, SYSTEMS THAT INCLUDE MOTION DETECTION, TRACKING, AND ANALYSIS.

DEACON RESEARCH
900 WELCH RD - STE 203
PALO ALTO, CA 94304
CONTRACT NUMBER:
DR DAVID A DEACON
TITLE:
NON-INTERCEPTING ENERGY MONITOR FOR HIGH POWER BEAMS
TOPIC# 1 OFFICE: IDENT#: 38079

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FREE ELECTRON LASER OPERATIONS REQUIRES ON-LINE CONTROL OF THE ELECTRON BEAM PARAMETERS INCLUDING THE ENERGY AND THE ENERGY SPREAD. PRESENT ENERGY MEASUREMENT TECHNOLOGY REQUIRES INTERRUPTION OF LASER OPERATION AS THE ELECTRON BEAM IS DIVERTED AND FOCUSED ONTO A DETECTOR WIRE. THE HIGH BEAM POWER LEVEL OF THE ACCELERATORS REQUIRED FOR THE FUTURE WILL ALSO MELT OR VAPORIZE THE DETECTOR WIRE. NON-INTERCEPTING BEAM DIAGNOSTICS ARE REQUIRED SO THAT HIGH POWER BEAMS CAN BE MEASURED WITHOUT DISTURBING LASER OPERATION. IN THIS INVESTIGATION, FEASIBILITY IS BEING DETERMINED OF NON-INTERCEPTING MONITOR WHICH OBTAINS BEAM INFORMATION FROM THE CHARACTERISTICS OF THE SPONTANEOUS EMISSION SPECTRUM OF AN OPTICAL KLYSTRON. THIS TECHNOLOGY HAS BEEN USED TO MEASURE THE ENERGY SPREAD AND EMITTANCE OF THE ELECTRON BEAM IN A STORAGE RING. THE CENTRAL PROBLEM FOR THIS STUDY IS PERFORMANCE OPTIMIZATION GIVEN THE LOW LIGHT LEVEL CHARACTERISTIC OF LINEAR ACCELERATORS. SPECIFIC MEASURES ARE BEING DEVELOPED TO OPTIMIZE PERFORMANCE SUBJECT TO THE CONSTRAINTS IMPOSED BY LINEAR ACCELERATOR OPERATION. ACCURACY AND DYNAMIC RANGE OF THE DEVICE ARE ALSO BEING PROJECTED. SUCCESSFUL IMPLEMENTATION OF AN OPTICAL KLYSTRON BEAM MONITOR WOULD MAKE POSSIBLE, FOR THE FIRST TIME, ON-LINE FEEDBACK CONTROL OF THE ENERGY AND ENERGY SPREAD OF LINEAR ACCELERATOR BEAMS, AT FULL POWER, WITHOUT DISTURBING FREE ELECTRON LASER OPERATION. USE OF A PAIR OF OPTICAL KLYSTRONS YIELDS AN ON-LINE MEASUREMENT OF THE LASER EXTRACTION EFFICIENCY WHICH CAN BE USED TO OPTIMIZE THE UNDULATOR TAPER AND OPTICAL SYSTEM. FURTHER DEVELOPMENT OF THE DEVICE WILL YIELD MEASUREMENTS OF THE EMITTANCE AND (POSSIBLY) THE MICROPULSE LENGTH.

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CONTRACT NUMBER:

DOUGLAS BAMFORD

TITLE:

SELF MODELOCKED AMPLIFIER FREE ELECTRON LASER CONFIGURATION

TOPIC# 1

OFFICE:

IDENT#: 38347

THE REALIZATION OF A MASTER OSCILLATOR - POWER AMPLIFIER RADIO
FREQUENCY (RF) LINAC FREE ELECTRON LASER PRESENTS SEVERAL

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DIFFICULTIES. USE OF A SINGLE ACCELERATOR TO DRIVE BOTH OSCILLATOR AND AMPLIFIER IS PREFERRED BECAUSE THE COST IS LOWERED BY ALMOST A FACTOR OF TWO, BUT SOME MEANS MUST BE PROVIDED TO SORT THE ACCELERATOR PULSES BETWEEN THE OSCILLATOR AND THE AMPLIFIER. THE SORTING METHODS WHICH HAVE BEEN PROPOSED SUFFER FROM THE NEED FOR ADDITIONAL ACTIVE COMPONENTS WHICH HAVE SIGNIFICANT DISADVANTAGES, SUCH AS MODELOCKING OPTICS IN THE OSCILLATOR (LOW DAMAGE THRESHOLD), OR AN RF BEAM SEPARATION DEVICE COMPLETE WITH DUPLICATE BEAMLINE (HIGH COST). THE NEW APPROACH WE DEVELOPED HAS THE PROPERTY OF AUTOMATICALLY SORTING THE ELECTRON PULSES BETWEEN THE OSCILLATOR AND THE AMPLIFIER. THIS SCHEME WOULD PERMIT STABLE OPERATION OF AMPLIFIED RF LINAC FREE ELECTRON LASERS (FELs) IN A SIMPLER, MORE RELIABLE, LOWER COST CONFIGURATION. IN THIS PROJECT, A ONE DIMENSIONAL THEORETICAL MODEL DESCRIBING OUR APPROACH IS BEING DEVELOPED WITH ITS PERFORMANCE BEING CALCULATED UNDER THE LIKELY RANGE OF PARAMETERS FOR HIGH POWER FELs. ONCE SUCCESSFULLY DEMONSTRATED, THIS APPROACH, DUE TO ITS LOW COST AND SIMPLICITY, WOULD HAVE APPLICATION TO EVERY HIGH POWER FEL FACILITY. FUTURE COMMERCIAL APPLICATIONS OF HIGH POWER FELs COULD EXIST IN AREAS SUCH AS PHOTOCHEMISTRY OR MATERIALS PROCESSING.

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2200 CENTRAL AVE
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DR MARK A HANDSCHY
TITLE:
FERROELECTRIC LIQUID CRYSTALS FOR OPTICAL CROSSBAR SWITCHES
TOPIC# 11 OFFICE: IDENT#: 38365

THIS EFFORT INVESTIGATES THE USE OF THE HIGH-SPEED ELECTRO-OPTICAL PROPERTIES OF FERROELECTRIC LIQUID CRYSTALS (FLC) TO MAKE OPTICAL CROSSBAR SWITCHES. THESE SWITCHES WOULD PERMIT LARGE NUMBERS (HUNDREDS TO THOUSANDS) OF INPUT LIGHT BEAMS MODULATED AT GHz RATES TO BE CONNECTED TO AN EQUALLY LARGE NUMBER OF OUTPUTS. FLC SWITCHES ALSO REDUCES THE AMOUNT OF LIGHT LOST BETWEEN INPUT AND OUTPUT TO A SMALL FRACTION (1-2 dB) AS COMPARED TO THE USUAL VECTOR-MATRIX MULTIPLIER ARCHITECTURES. THE FAST SWITCHING OF FLCs ALLOWS THE ENTIRE CONNECTION PATTERN OF THE SWITCH TO BE RECONFIGURED IN

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MICROSECOND TO SUBMICROSECOND TIMES WITH PICOJoule LEVEL ENERGY
DISTRIBUTION. IN THIS INVESTIGATION, AN APPROPRIATE SWITCH GEOMETRY
IS BEING SELECTED AND AN INDIVIDUAL "PROOF-OF-CONCEPT" SWITCH WILL
BE DESIGNED, FABRICATED, AND TESTED. AT A LATER EFFORT, COMPLETE
MULTI-LINE CROSSBAR SWITCHES WILL BE DESIGNED AND FABRICATED.
MILITARY AND COMMERCIAL APPLICATIONS EXIST FOR THIS TECHNOLOGY IN
AREAS SUCH AS OPTICAL TELECOMMUNICATIONS SYSTEMS, SECURE BATTLE
MANAGEMENT NETWORKS, SENSOR NETWORKS, AND INTEGRATED OPTIC COMPUTING
SYSTEMS.

DYNATHERM CORP
1 BEAVER CT
COCKEYSVILLE, MD 21030
CONTRACT NUMBER:
DAVID A WOLF
TITLE:
LIQUID METAL HEAT PIPES WITH PHASE CHANGE MATERIAL STORAGE
TOPIC# 8 OFFICE: IDENT#: 38371

FUTURE MILITARY SPACECRAFT WILL REQUIRE HIGH TEMPERATURE RADIATORS
WHICH USE LIQUID METAL HEAT PIPES FOR REJECTING WASTE HEAT FROM
POWER GENERATION EQUIPMENT. STATE-OF-THE-ART TECHNOLOGY IS
ADEQUATE TO DESIGN LIQUID METAL HEAT PIPES FOR STEADY STATE OPERATION,
BUT MODELS FOR TRANSIENT PERFORMANCE ARE STILL UNDER DEVELOPMENT
AND LACK SUFFICIENT EXPERIMENTAL VERIFICATION. SEVERE TRANSIENTS
ARE ANTICIPATED IN MILITARY SPACECRAFT AS A RESULT OF PULSE POWER
GENERATION AND PULSED EXTERNAL HEAT LOADS TO THE RADIATOR. TO COPE
WITH SUCH PULSES, THE TRANSIENT BEHAVIOR MUST BE WELL UNDERSTOOD AND
TECHNIQUES FOR MITIGATING THE EFFECTS OF PULSE DEVELOPED. ONE
PROMISING TECHNIQUE IS THE INCORPORATION OF THERMAL STORAGE INTO THE
HEAT PIPE. CURRENTLY, ADVANCED TRANSIENT MODES ARE BEING DEVELOPED
OF LIQUID METAL HEAT PIPES WITH THERMAL STORAGE. IN THIS PROGRAM,
TEST ARTICLES ARE BEING DEVELOPED FOR LIQUID METAL HEAT PIPE
RESEARCH. SEVERAL LIQUID METAL HEAT PIPES WITH INTEGRAL THERMAL
ENERGY STORAGE ARE BEING DESIGNED AND FABRICATED. AFTER STEADY STATE
PERFORMANCE CHARACTERIZATION IN THE LABORATORY, THE HEAT PIPES ARE
BEING PREPARED FOR TRANSIENT TEST IN LIQUID SODIUM HEAT TRANSFER
LOOP.

E.R.G. SYSTEMS INC
BRACKENWOOD PATH
ST JAMES, NY 11780
CONTRACT NUMBER:
JOHN L REMO
TITLE:
FULL-SURFACE INTERFEROMETRIC TESTING OF GRAZING INCIDENCE MIRRORS
TOPIC# 1 OFFICE: IDENT#: 38382

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THE NEED EXISTS FOR A METHOD TO CHARACTERIZE AND QUALIFY THE NECESSARY OFF-AXIS ASPHERICAL MIRROR TECHNOLOGY FOR USE IN WEAPON POINTING, BEAM CONTROL, AND BEAM PROPAGATION THROUGH SEVERAL ENVIRONMENTS AND COUNTERMEASURES. CURRENTLY, NO INSTRUMENT EXISTS THAT CAN MEASURE BOTH THE FULL SURFACE FIGURE AS WELL AS THE SURFACE ROUGHNESS. IN THIS INVESTIGATION, FEASIBILITY IS BEING DETERMINED OF A FULL-SURFACE INTERFEROMETRIC APPROACH CAPABLE OF TESTING GRAZING INCIDENCE MIRRORS. THIS METHOD, BASED ON THE USE OF NORMAL INCIDENCE, SUB-APERTURE INTERFEROMETRY AND POLARIZATION SHARING INTERFEROMETRY, SURMOUNTS MANY OF THE PROBLEMS ENCOUNTERED BY OTHER TECHNIQUES. THE SYSTEM INVOLVES THREE SEQUENTIAL OPERATIONS: SUB-APERTURE SLOPE MEASUREMENT, WAVEFRONT INTEGRATION AND SURFACE PROFILE SYNTHESIS. WHEN SUCCESSFULLY DEVELOPED, THE RESULTING INSTRUMENT WOULD FIND APPLICATION IN X-RAY AND UV HIGH RESOLUTION LITHOGRAPHY, MEDICAL DIAGNOSTIC IMAGING, BASIC RESEARCH IMAGING IN ASTRONOMY, PHYSICS, AND MICROBIOLOGY.

EIC LABS INC
111 DOWNEY ST
NORWOOD, MA 02062
CONTRACT NUMBER:
TIMOTHY L ROSE
TITLE:
THIN FILM CAPACITORS FOR MICROCIRCUITS BY IN-SITU PRODUCTION
TOPIC# 14 OFFICE: IDENT#: 38170

PRESENT TECHNOLOGY REQUIRES CLASS II CAPACITORS TO BE MOUNTED SEPARATELY AS MONOLITHIC CHIPS BECAUSE THEIR HIGH FABRICATION TEMPERATURES ARE NOT COMPATIBLE WITH THE MATERIALS USED IN MAKING MICROCIRCUITS. THIS PROJECT DEMONSTRATES THE FEASIBILITY OF MAKING HIGH DIELECTRIC CONSTANT THIN FILMS OF BaTiO_3 -BASED DIELECTRICS BY RF-SPUTTER DEPOSITION FOLLOWED BY LASER ANNEALING BaTiO_3 FILMS FROM 0.5 TO 2.5 MICRONS THICK ARE SPUTTER DEPOSITED ONTO SUBSTRATES HEATED TO $<500^\circ\text{C}$. THE FILMS ARE THEN ANNEALED TO PRODUCE POLYCRYSTALLINE BaTiO_3 WITH DIELECTRIC CONSTANTS UP TO 2000. THE TEMPERATURE AND FREQUENCY DEPENDENCE OF THE CAPACITANCE AND DISSIPATION FACTOR, THE INSULATION RESISTANCE, AND THE DIELECTRIC BREAKDOWN STRENGTH OF THE FILMS IS THEN MEASURED. DIRECT FABRICATION

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OF THIN FILM CAPACITORS TO REPLACE MONOLITHIC CERAMIC CHIPS OFFERS ADVANTAGES FOR ELECTRONIC COMPONENTS UTILIZING HYBRID MICROCIRCUITS. HYBRID CIRCUITS ARE FOUND IN DEFENSE AND COMMERCIAL APPLICATIONS INCLUDING MICROWAVE MODULES, RADIOS, COMPUTERS, TELECOMMUNICATIONS EQUIPMENT, AND AUTOMOTIVE APPLICATIONS.

EIC LABS INC
111 DOWNEY ST
NORWOOD, MA 02062
CONTRACT NUMBER:
MARTIN W RUPICH

TITLE:

PATTERNING TECHNIQUES FOR THIN FILM HIGH TEMPERATURE
SUPERCONDUCTING DEVICE FABRICATION

TOPIC# 15

OFFICE:

IDENT#: 38171

BEFORE THE FULL POTENTIAL OF RECENTLY DEVELOPED HIGH T_c SUPERCONDUCTORS CAN BE EXPLOITED AND PRACTICAL DEVICES PRODUCED, ADVANCED FABRICATION TECHNIQUES FOR FILM GROWTH AND PATTERNING MUST BE DEVELOPED. THE OBJECTIVE OF THIS PROGRAM IS TO DEVELOP A GROWTH AND PATTERNING METHOD FOR THIN $YBa_2Cu_3Y(OR)_7-x$ FILMS BASED ON THE DIRECT LASER OR ELECTRON BEAM WRITING OF DENSE $Cu_2O_3BaY(OR)_7$ PRECURSOR FILMS WHICH ARE ISOSTRUCTURAL TO THE SUPERCONDUCTING $YBa_2Cu_3Y(OR)_7-x$. THIS PROGRAM EXPLORES A PATTERNING TECHNIQUE WHICH USES THE PROPERTIES OF $Cu_3O_3Ba_2Y(OR)_7$ TO PROMOTE THE FORMATION OF WELL DEFINED, DENSE, ORIENTED $YBa_2Cu_3Y(OR)_7-x$ FILMS. OPTIMIZATION OF THE FILM FORMATION AND PATTERNING TECHNIQUES NEEDED TO PRODUCE HIGH QUALITY THIN FILM $YBa_2Cu_3Y(OR)_7-x$ STRUCTURES THAT CAN BE USED FOR THE NEAR-TERM FABRICATION OF INFRARED ARRAYS, SIS MIXERS, AND SQUIDS IS THE NEAR-TERM GOAL FOR THE PROJECT. SUCCESSFUL DEMONSTRATION OF A VERSATILE AND LOW COST PATTERNING TECHNIQUE COULD SIGNIFICANTLY ADVANCE THE DEVELOPMENT AND APPLICATION OF PRACTICAL HIGH TEMPERATURE SUPERCONDUCTOR DEVICES FOR MILITARY, COMMERCIAL, AND SCIENTIFIC APPLICATIONS IN INTEGRATED CIRCUIT INTERCONNECTS, INFRARED FOCAL PLANE ARRAY MATERIALS, SIS MIXERS, AND SQUIDS.

EIC LABS INC
111 DOWNEY ST
NORWOOD, MA 02062
CONTRACT NUMBER:
G L HOLLECK

TITLE:

SUPERHIGH ENERGY DENSITY LITHIUM BROMINE TRIFLUORIDE BATTERY

TOPIC# 5

OFFICE:

IDENT#: 38172

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MODERN DEFENSE SYSTEMS DEPEND ON THE AVAILABILITY OF HIGH ENERGY DENSITY POWER SOURCES. GREAT ADVANCES HAVE BEEN MADE OVER THE PAST DECADE BASED ON THE UNCONVENTIONAL APPROACH OF COMBINING ALKALI METALS WITH STRONGLY OXIDIZING LIQUIDS (E.G., SO_2 , SOCl_2) WHICH ACT SIMULTANEOUSLY AS ELECTROLYTE SOLVENT AND CATHODE DEPOLARIZER. IN THIS STUDY, THIS PRINCIPLE IS BEING APPLIED TO EVEN MORE POWERFUL OXIDIZING AGENTS, THE INTERHALOGEN COMPOUNDS. SPECIFICALLY, A LITHIUM BROMINE TRIFLUORIDE (Li/BrF_3) BATTERY IS BEING DEVELOPED. SUCH A BATTERY OFFERS THE REMARKABLE POTENTIAL TO DOUBLE THE HIGHEST PRESENTLY AVAILABLE ENERGY DENSITIES. WHILE ITS CELL VOLTAGE IS IN EXCESS OF 5V, ITS GRAVIMETRIC ENERGY DENSITY IS NEARLY TWICE THAT OF THE Li/SOCl_2 CELL. THE GENERAL TREND TOWARDS INDEPENDENCE AND PORTABILITY OF EQUIPMENT PLACES A PREMIUM ON THE WEIGHT AND VOLUME OF POWER SOURCES. THEREFORE, A WIDE POTENTIAL IS EXPECTED FOR COMMERCIAL APPLICATIONS OF Li/BrF_3 BATTERIES, E.G., IN VCR CAMERAS, RECORDERS, COMPUTERS AND VARIOUS PORTABLE SENSORS AND COMMUNICATION DEVICES.

ELECTRIC PROPULSION LAB INC
43423 DIVISION ST - STE 205
LANCASTER, CA 93535
CONTRACT NUMBER:
DR GRAEME ASTON
TITLE:
DUAL MODE HIGH THRUST HYDROGEN ARCJET
TOPIC# 6 OFFICE: IDENT#: 38093

A DUAL MODE, HYDROGEN ARCJET FOR USE ON LARGE SPACE PLATFORMS IS BEING INVESTIGATED. LARGE STRATEGIC DEFENSE PLATFORMS WITH CRYOGENICALLY STORED HYDROGEN REQUIRE A SYSTEM TO DUMP THE HYDROGEN BOIL-OFF. A HYDROGEN ARCJET, OPERATING OVER A WIDE VARIETY OF MASS FLOW RATES, COULD BE USED TO DUMP THIS HYDROGEN AND IN DOING SO PROVIDE NECESSARY PLATFORM PROPULSION FUNCTIONS RANGING FROM STATION-KEEPING TO OPERATIONAL ORBIT CHANGING. THIS DUAL MODE, HYDROGEN ARCJET HAS TWO MODES OF OPERATION: A MODERATE POWER (10 kW), HIGH SPECIFIC IMPULSE (1500 s) MODE FOR STATION KEEPING, AND A HIGH THRUST (10 n), HIGH POWER (60 kW), HIGH MASS FLOW RATE MODE FOR MAKING RELATIVELY RAPID ORBIT ADJUSTMENTS. THERMAL ANALYSES

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ARE BEING PERFORMED TO DETERMINE THE FEASIBILITY OF USING REGENERATIVE COOLING TO MAINTAIN REASONABLE ANODE AND CATHODE ELECTRODE TEMPERATURES FOR OPERATION IN THE HIGH POWER, HIGH THRUST MODE. EXPERIMENTAL EVALUATION IS ALSO BEING CONDUCTED OF HIGH TEMPERATURE, HIGH PRESSURE HYDROGEN SEALING TECHNIQUES. THE USE OF HYDROGEN BOIL-OFF IN AN ARCJET PROPULSION SYSTEM TO PROVIDE PROPULSION FUNCTIONS FOR LARGE SPACE PLATFORMS WOULD ELIMINATE THE NEED FOR A SEPARATE PROPULSION SYSTEM PROPELLANT SUPPLY. FURTHERMORE, THE NECESSARY FUNCTIONS OF HYDROGEN BOIL-OFF DUMPING, STATION-KEEPING PROPULSION, AND ORBITAL MANEUVERING PROPULSION COULD BE PROVIDED BY A SINGLE SYSTEM. THE ATTENDANT MASS SAVINGS AND SYSTEM SIMPLIFICATION COULD SIGNIFICANTLY REDUCE PLATFORM COSTS.

ELECTRO-OPTEK CORP
3152 KASHIWA ST
TORRANCE, CA 90505
CONTRACT NUMBER:
MICHAEL LEE
TITLE:
ION-BEAM EPITAXY OF SILICON-ON-INSULATOR
TOPIC# 14 OFFICE: IDENT#: 38176

ON THIS PROJECT, AN ION BEAM EPITAXY (IBE) TECHNIQUE COMPLEMENTS AN MOLECULAR BEAM EPITAXY (MBE) FABRICATION TECHNIQUE TO PRODUCE HIGHER QUALITY SILICON (Si) ON CaF_2/Si SUBSTRATES, THE $\text{Si-ON-CaF}_2/\text{Si}$ STRUCTURE IS USED AS THE TEST VEHICLE BECAUSE ITS MBE GROWTH HAS BEEN DEMONSTRATED AND IT IS HIGHLY SOUGHT AFTER FOR THE FABRICATION OF THREE-DIMENSIONAL AND RADIATION-HARD ELECTRONICS. THIS EFFORT USES AN ION BEAM OF Si GENERATED BY AN ELECTRON CYCLOTRON RESONANCE (ECR) SOURCE TO REDUCE THE CRYSTAL MISFIT DISLOCATIONS AND TO MINIMIZE THE CHEMICAL REACTION OF THE CaF_2 WITH SILICON. THIS PROCESS LEADS TO THE LOW-TEMPERATURE, LOW DEFECT GROWTH OF SILICON-ON-INSULATOR (SOI) WAFERS.

EMCORE CORP
35 ELIZABETH AVE
SOMERSET, NJ 08873
CONTRACT NUMBER:
DR RICHARD A STALL
TITLE:
HIGH THROUGHPUT MULTI-WAFER GROWTH OF INDIUM-GALLIUM-ARSENIDE-PHOSPHIDE STRUCTURES
TOPIC# 14 OFFICE: IDENT#: 38374

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WITH THE CONTINUED GROWTH OF THE FIBER OPTICS COMMUNICATIONS INDUSTRY AND THE EMERGING MARKET FOR VISIBLE LASERS, THE NEED FOR GREATER VOLUMES OF InGaAsP MATERIALS IS SIGNIFICANT. NEARLY ALL MAJOR WORK ON THE GROWTH OF InGaAsP STRUCTURES HAS BEEN PERFORMED ON SINGLE WAFER, LOW THROUGHPUT MACHINES. THIS PROJECT DEMONSTRATES THE USE OF METAL-ORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) FOR MULTI-WAFER GROWTH OF InGaAsP EPILAYERS IN A LOCKLOADED SYSTEM. INITIAL EFFORTS ARE DEMONSTRATING THICK LAYER AND QUANTUM WELL GROWTH OF InGaAs/InP STRUCTURES. LATER, LAYER PURITY, UNIFORMITY, AND INTERFACE ABRUPTNESS WILL BE STUDIED AS A FUNCTION OF GROWTH TEMPERATURE AND GAS INJECTION SCHEMES. DEVELOPMENT OF HIGH THROUGHPUT GROWTH TECHNIQUES FOR InGaAsP HAS MAJOR IMPLICATIONS IN APPLICATIONS INCLUDING VISIBLE LASERS, LOW-NOISE MICROWAVE DEVICES, AND LONG WAVELENGTH EMITTERS AND DETECTORS FOR FIBER OPTIC COMMUNICATIONS.

ENERGY COMPRESSION RESEARCH CORP

910 CAMINO DEL MAR - STE A

DEL MAR, CA 92014

CONTRACT NUMBER:

OVED ZUCKER

TITLE:

ENERGY STORAGE ENHANCEMENT IN HIGH ENERGY DENSITY CAPACITORS

TOPIC# 5

OFFICE:

IDENT#: 38375

AN APPROACH TO SIGNIFICANTLY INCREASE THE ENERGY DENSITY OF CAPACITORS IN REP-RATED APPLICATIONS IS BEING INVESTIGATED. THIS TECHNIQUE IS APPLICABLE ONLY TO REP-RATED APPLICATIONS SINCE IT UTILIZES THE FIXED CHARGE AND DISCHARGE DURATION CHARACTERISTICS NEEDED FOR THESE APPLICATIONS TO TAILOR THE CHARGE DYNAMICS AT THE METAL DIELECTRIC BOUNDARY REGION. THE TECHNIQUE BEING EMPLOYED REPRESENTS PARALLEL DEVELOPMENT PATHS TO THOSE CURRENTLY PURSUED. THIS APPROACH INVOLVED OVERCOMING TWO FUNDAMENTAL CONSTRAINTS TO ENERGY DENSITY: THE INEVITABLE DERATING OF THE DIELECTRIC STRENGTH OF THE MATERIAL DUE TO DISCONTINUITIES IN THE METAL OR DIELECTRIC, AND THE EXTRA MATERIAL WHICH MUST BE ALLOWED AT THE EDGES OF THE CAPACITOR TO HOLD THE VOLTAGE AT THE EDGE. THE TECHNIQUES REQUIRE THAT THE CYCLE OF THE CAPACITOR BE PRESCRIBED. TRANSIENT VOLUME

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CHARGE DISTRIBUTIONS PREVENT FIELD ENHANCEMENT BOTH AT THE METALIZATION AND DIELECTRIC SURFACE. ELECTROPHORETIC DEPOSITION, POSSIBLY LANGMUIR-BLODGETT FILM TECHNIQUES, ARE BEING USED FOR SURFACE TREATMENT. SUCCESSFUL DEVELOPMENT OF THESE TECHNIQUES WOULD SIGNIFICANTLY INCREASE THE ENERGY STORAGE DENSITY OF CAPACITORS FOR TRANSIENT APPLICATIONS. THESE TECHNIQUES COULD BE COMBINED WITH ONGOING WORK IN MATERIALS AND FABRICATION TO IMPROVE POWER CONDITIONING TECHNOLOGY FOR SPACE POWER APPLICATIONS

ENERGY SCIENCE LABS INC

PO BOX 85608

SAN DIEGO, CA 92138

CONTRACT NUMBER:

TIMOTHY R KNOWLES

TITLE:

ELECTROCALORIC MATRIX COMPOSITE

TOPIC# 7

OFFICE:

IDENT#: 38376

THE FEASIBILITY IS BEING INVESTIGATED OF USING ELECTROCALORIC SUBSTANCES AS THE MATRIX IN THERMAL COMPOSITE MATERIALS FOR THE PURPOSE OF ACHIEVING ELECTRICALLY CONTROLLABLE HEAT TRANSFER. THERMAL COMPOSITES CONSIST OF HIGH-CONDUCTIVITY (FIN-LIKE) STRUCTURES DISPERSED IN A HIGH-HEAT-CAPACITY MATRIX. SUCH COMPOSITES HAV BOTH HIGH THERMAL CONDUCTIVITY AND HIGH HEAT CAPACITY, WHICH MAKES THEM USEFUL FOR TRANSIENT THERMAL STORAGE APPLICATIONS. REPLACING THE MATRIX WITH ELECTROCALORIC MATRIALS, SUCH AS NEW ORGANIC FERROELECTRICS EXHIBITING FIELD-INDUCED PHASE TRANSITIONS, IS EXPECTED TO ALLOW ELECTRICALLY CONTROLLED HEAT TRANSFER WITHIN THE COMPOSITE. THE HIGH THERMAL CONDUCTIVITY OF THE COMPOSITE PERMITS LARGE HEAT CURRENT RESPONSE PARALLEL TO THE CONDUCTING COMPONENTS, WHILE THE LOW ELECTRICAL CONDUCTIVITY PERPENDICULAR LIMITS ELECTRICAL LOSSES. THESE MATERIALS ARE POTENTIALLY FAR MORE EFFICIENT THAN SEMICONDUCTING THERMOELECTRIC DEVICES AND COULD BE USED IN VARIABLE CONDUCTANCE THERMAL SHUNTS, THERMAL SWITCHED AND DIODES, AND IN HEAT PUMPS. EXPERIMENTS TO CHARACTERIZE DYNAMIC ELECTRICAL AND THERMAL RESPONSE OF SELECTED COMPOSITES ARE BEING CONDUCTED. THIS EXPLORATORY WORK IS AIMING TO ESTABLISH THE EXISTENCE OF ELECTRICALLY CONTROLLABLE HEAT TRANSFER EFFECTS IN THESE COMPOSITES AND TO STUDY THEIR CONTROL. IF THESE OBJECTIVES ARE MET, APPLICATION TO HEAT-PUMP-

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ASSISTED COUPLING OF A SPACE PLATFORM THERMAL BUS TO SPACE RADIATORS AND TO THERMAL ENERGY STORAGE UNIT WILL BE INVESTIGATED IN A LATER EFFORT. WHEN SUCCESSFUL, THESE MATERIALS COULD FORM THE BASIS FOR A NEW CLASS OF ACTIVE SOLID STATE DEVICES SUCH AS COMPACT HEAT PUMPS, ELECTRIC POWER GENERATORS USING WASTE HEAT, REFRIGERATORS, CONTROLLABLE CONDUCTANCE DEVICES, THERMAL DIODES AND SWITCHES. THEY WOULD EXHIBIT HIGH-HEAT-FLUX CAPABILITY, EFFICIENCY, AND RELIABILITY EQUAL TO ELECTRIC FIELD DRIVERS.

ENYON BATTERY CO
1742 N DRIFTWOOD DR
PROVO, UT 84602
CONTRACT NUMBER:
DR DOUGLAS N BENNION

TITLE:
HIGH POWER SHORT PULSE BATTERY/CAPACITOR
TOPIC# 5 OFFICE: IDENT#: 38183

BIPOLAR BATTERIES CAN, IN PRINCIPLE, YIELD ORDERS OF MAGNITUDE HIGHER SPECIFIC POWER THAN CONVENTIONAL, PARALLEL PLATE BATTERIES. SUCH BATTERIES BEGIN TO HAVE PERFORMANCE CHARACTERISTICS SIMILAR TO CAPACITORS AND COULD POSSIBLY BE USED TO REPLACE CAPACITOR FOR SOME APPLICATIONS. BATTERY PERFORMANCE OF BETWEEN 5 AND 2 A/cm² AT 1.0 V CELL POTENTIAL FOR A TIME PERIOD OF 500 MICROSECONDS WITH ELECTRODES 250 MICROSECONDS THICK HAVE BEEN ACHIEVED IN PRACTICAL CONFIGURATIONS. IN THIS STUDY, THREE CELL BATTERY STACKS WHICH YIELD 1 V PER CELL AND 5 A/cm² ARE BEING BUILT AND DEMONSTRATED. THIS DEMONSTRATION IMPLIES A CORE SPECIFIC POWER OF 100 kW/kg, AND ASSUMES A CELL THICKNESS OF 250 μ m AND AN AVERAGE DENSITY OF 2 g/cm³. MORE IDEALIZED EXPERIMENTAL AND THEORETICAL CELL RESULTS SUGGEST THAT A SHORT TERM GOAL OF 10 A/cm² AT 1.0 V CELL POTENTIAL FOR 1 ms WITH CELLS 125 MICROSECONDS THICK COULD BE POSSIBLE, IMPLYING A SPECIFIC POWER OF 400 kW/kg. RAILGUNS AND LASERS ARE BEING CONSIDERED AS WEAPONS AS PART OF THE STRATEGIC DEFENSE PROGRAM. IN ORDER TO DRIVE SUCH DEVICES, HIGH PULSES OF POWER IN THE GIGAWATT RANGE ARE NEEDED FOR TIME PERIODS OF MILLISCONDS. THE BATTERIES BEING DEVELOPED IN THIS PROGRAM WILL, WHEN SUCCESSFUL, BE ABLE TO DELIVER SUCH POWER PULSES WITH LESS WEIGHT AND COST THAN ALTERNATE METHODS.

EPION CORP
53 FIFER LN
LEXINGTON, MA 02173
CONTRACT NUMBER:
ALLEN R KIRKPATRICK

TITLE:
NUCLEATION SITE ARRAYS FOR IMPROVED GROWTH OF CRYSTALLINE DIAMOND FILM
TOPIC# 14 OFFICE: IDENT#: 38381

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DIAMOND FILMS ON NON-DIAMOND SUBSTRATES ARE USUALLY CHARACTERIZED BY HIGHLY DISORDERED MICROSTRUCTURE, LOW FILM DENSITY, AND POOR MORPHOLOGY; RESULTING IN DIFFICULTIES IN PRODUCING LARGE AREA, HIGH QUALITY FILMS. THE NUCLEATION AND GROWTH BEHAVIORS OF DIAMOND FILM ALLOW THE EMPLOYMENT OF ARRAYS OF SMALL, SHALLOW CRATERS INTRODUCED INTO A HIGH-QUALITY SUBSTRATE SURFACE BY FOCUSED ION BEAM MILLING TO SPECIFY THE LOCATION AND REPETITION PATTERN OF DOMINANT NUCLEATION SITES. DEPOSITION ONTO SUBSTRATES PREPARED IN THIS MANNER SHOULD RESULT IN IMPROVED DIAMOND FILMS WHICH ARE MORE SUITABLE FOR ELECTRONIC DEVICE DESIGN AND FABRICATION. THIS STUDY VALIDATES THE INDUCED NUCLEATION SITE ARRAY CONCEPT AND DEMONSTRATES THE IMPROVED QUALITY OF DIAMOND FILMS. SUCCESSFUL DEMONSTRATION OF THIS TECHNIQUE WILL RESULT IN A SUBSTRATE PREPARATION PROCESS COMPATIBLE WITH MOST DIAMOND DEPOSITION PROCESSES.

EXCEL TECHNOLOGY INC
140-20 KEYLAND CT
BOHEMIA, NY 11716
CONTRACT NUMBER:
DR RAMA RAO
TITLE:

CONTROLLED THIN FILM GROWTH OF HIGH T_c TiBaCaCuO ON SILICON
SUBSTRATE AT LOW TEMPERATURE

TOPIC# 15 OFFICE: IDENT#: 38184

THIS RESEARCH PROJECT IS TO DEVELOP EPITAXIAL GROWTH OF A THIN FILM OF HIGH TEMPERATURE Ti-Ba-Ca-Cu-O (TBCCO) SUPERCONDUCTOR ON A SILICON SUBSTRATE AT LOW PROCESSING TEMPERATURES BY LASER INDUCED DEPOSITION. A THIN FILM IS PREPARED BY PLASMA ASSISTED LASER DEPOSITION USING 265 nm UV LASER AT 10 Hz. A HIGH FLUX OF UV PHOTONS IS THEN DIRECTED ONTO THE TBCCO SUPERCONDUCTING TARGET, WHICH IS IN CLOSE PROXIMITY TO THE Si SUBSTRATE. AN ADVANTAGE TO THIS TECHNIQUE IS THAT PRECISELY CONTROLLED THIN FILMS OF DESIRE STOICHIOMETRY CAN BE DEPOSITED WITH ONLY ONE TARGET, AT LOW PROCESSING TEMPERATURE (450 DEGREES C) WITHOUT THE NEED OF ANY HIGH TEMPERATURE POST ANNEALING. ONCE A HIGH QUALITY THIN FILM IS PRODUCED, A PORTION OF THE FILM WILL BE PATTERNED INTO A 10 MICRON WIDE LINE BY LASER INDUCED ETCHING USING A 532 nm VISIBLE LASER AT KHz. POTENTIAL COMMERCIAL

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APPLICATIONS ARE FOR HIGHLY SENSITIVE INFRARED DETECTION, SUB-mm AND
MICROWAVE GENERATION, HIGH SPEED OPTICAL SWITCHING, AND
SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES (SQUID).

EXCEL TECHNOLOGY INC

140-20 KEYLAND CT

BOHEMIA, NY 11716

CONTRACT NUMBER:

DR RAMA RAO

TITLE:

HIGH SPEED SUPERCONDUCTOR-INSULATOR-SUPERCONDUCTOR QUANTUM SENSOR

IN THE 10-100 MICRON REGION FABRICATED WITH HIGH T_c BiCaSrCuO

TOPIC# 3 OFFICE: IDENT#: 38187

IN THIS PROGRAM, FEASIBILITY IS BEING DETERMINED OF DEVELOPING AND
CHARACTERIZING A HIGH SPEED QUANTUM DETECTOR IN THE 10-100 μ WAVE-
LENGTH REGION USING A SUPERCONDUCTOR-INSULATOR-SUPERCONDUCTOR (SIS)
TYPE WEAK LINK OF Bi-Ca-Sr-Cu-O. THESE DETECTORS OFFER CONSIDERABLE
PROMISE IN THE AREA OF FAR INFRARED SENSING BY PROVIDING EARLY
WARNING OF ATTACK AND KILL DEMONSTRATION FOR A SPACE BASE BALLISTIC
MISSILE DEFENSE SYSTEM. IN A PRELIMINARY EXPERIMENT, OBSERVATION
WAS MADE FOR THE FIRST TIME OF NOT ONLY A SLOW BOLOMETRIC RESPONSE,
BUT ALSO A FAST NON-THERMAL QUANTUM RESPONSE DUE TO COOPER PAIR
BREAKING AND QUASI-PARTICLES GENERATION IN YBaCuO FILM SUBJECTED TO
PULSED 532 nm LASER. IN THE PRESENT WORK, PRECISELY CONTROLLED
SUPERCONDUCTING, INSULATING, AND SUPERCONDUCTING THIN FILMS OF
Bi-Ca-Sr-Cu-O ARE BEING DEPOSITED ON A SUITABLE SUBSTRATE BY PLASMA
ASSISTED LASER DEPOSITION USING 265 nm UV LASER AT 10 Hz. SUBSEQUENT
TO DEPOSITION, SUPERCONDUCTING WEAK LINK SIS TYPE JOSEPHSON JUNCTION
WILL BE FABRICATED BY PATTERNING THESE FILMS WITH 532 nm VISIBLE
LASER AT 1 KHz. FOR DETECTION, INFRARED RADIATION FROM CO₂ LASER AT
10.6 μ WILL BE MODULATED AND GUIDED THROUGH AN OPTICAL FIBER TO THE
DETECTOR AT 10.6 μ AND THE TEMPERATURE DEPENDENCE OF THE RESPONSE
WILL BE STUDIED. THE RESPONSIVITY OF THE DETECTOR IS ESTIMATED TO
BE 10 TO THE 4TH V/W, WHICH IS SEVERAL ORDERS OF MAGNITUDE HIGHER
THAN PRESENTLY AVAILABLE QUANTUM DETECTORS. AT A LATER EFFORT,
WAVELENGTH DEPENDENCE OF THE RESPONSE IN THE 10-100 μ REGION, HIGH
FREQUENCY RESPONSE, AND TEMPERATURE DEPENDENCE OF THE RESPONSE TIME
WILL BE INVESTIGATED. POTENTIAL COMMERCIAL APPLICATIONS OF THIS

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DEVICE EXIST IN THE FAR INFRARED SPECTROMETER, RADIOMETER, NIGHT VISION, AND OPTICAL COMMUNICATION.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER:
UDAY K KASHALIKAR
TITLE:
COMPLEX SHAPED GRAPHITE/ALUMINUM COMPONENT FABRICATION METHOD
TOPIC# 13 OFFICE: IDENT#: 38104

A INNOVATIVE METAL MATRIX COMPOSITE (MMC) TECHNIQUE FOR NEAR-NET SHAPE FABRICATION OF SPACE STRUCTURAL JOINTS INVOLVES FABRICATION OF CUSTOM-TAILORED SPECIALIZED PREFORMS FOLLOWED BY INFILTRATION WITH MOLTEN ALUMINUM. PRESSURIZATION DURING THE INFILTRATION PROCESS PRODUCES STRUCTURAL JOINTS WITH A HIGH FIBER CONTENT AND THINNER WALLS THAN THOSE PRODUCED WITH CONVENTIONAL VACUUM-ASSISTED LIQUID METAL INFILTRATION (LMI). IN THIS STUDY, A COMPLEX-SHAPED SUBSCALE TRUSS JOINT COMPONENT IS BEING FABRICATED WITH EXPECTED FIBER CONTENT ABOVE 60 PERCENT BY VOLUME AND WALL THICKNESS AROUND 0.010 TO 0.020 INCHES. IN THE FOLLOW-ON EFFORT, A FULL-SCALE COMPONENT WILL BE FABRICATED AND GRAPHITE FIBER COATINGS DEVELOPED TO IMPROVE MMC TRANSVERSE STRENGTH. LOWER COST GRAPHITE METAL MATRIX COMPOSITES PROMOTE DEFENSE AND CIVIL APPLICATIONS THAT REQUIRE HIGH STRENGTH, LIGHT WEIGHT, STIFFNESS, AND HIGH TEMPERATURE CAPABILITY. THIS ECONOMICAL TECHNIQUE IS SUITED TO PRODUCE NEAR-NET SHAPE STRUCTURES WITH COMPLEX GEOMETRIES, SUCH AS AUTOMOTIVE ENGINE BLOCKS, CONNECTING RODS, FLYWHEELS, AND AIRCRAFT JOINTS AND FITTINGS.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER:
RICHARD W LUSIGNEA
TITLE:
HIGH CRITICAL CURRENT DENSITY SUPERCONDUCTING OXIDES VIA A THREE DIMENSIONAL TEMPLATE
TOPIC# 15 OFFICE: IDENT#: 38106

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THE OBJECTIVE OF THIS PROJECT IS TO PRODUCE HIGH CRITICAL CURRENT (Jc) SUPERCONDUCTING OXIDE (SCO) FIBERS, FILMS, AND SHAPES BY ORIENTING THE CRYSTAL STRUCTURE. THIS IS BEING ACCOMPLISHED BY TAKING ADVANTAGE OF THE HIGH TEMPERATURE CAPABILITY AND OPEN FIBILLAR NETWORK OF CERTAIN LIQUID CRYSTAL POLYMERS (LCP). THE OPEN, CONNECTED, AND ORIENTED NETWORK IS FILLED USING SOL-GEL TECHNIQUES, AND THEN FIRED. SINCE THE LCPs MAINTAIN THEIR STRUCTURE AT HIGHER TEMPERATURE (600 DEGREES C) THAN THE PEROVSKITES TAKE TO FORM (ABOUT 500 DEGREES C), THE LCPs ACT AS A THREE-DIMENSIONAL TEMPLATE AND FORCE THE ORIENTATION OF THE SCO CRYSTALS AS THEY FORM. THE LCPs WILL EVENTUALLY BURN OFF, LEAVING AN INTERCONNECTED AND PROPERLY ORIENTED SCO MATRIX. A POTENTIAL BENEFIT OF THIS PROCESS IS THE ABILITY TO PRODUCE NET SHAPE ORIENTED HIGH Jc PARTS WITH APPLICATION IN HIGH CURRENT DENSITY ITEMS SUCH AS ELECTRONIC INTERCONNECTS, WHICH ARE PRESENTLY BEYOND THE RANGE OF HIGH TEMPERATURE SUPERCONDUCTORS.

GEMINI COMPUTERS INC (ICS DIV)

PO BOX 222417

CARMEL, CA 93922

CONTRACT NUMBER:

DR TIEN F TAO

TITLE:

HIGH ASSURANCE MULTILEVEL-SECURE WORKSTATIONS AND PERSONAL

COMPUTERS WITH ENCRYPTION AND NETWORK SUPPORTS

TOPIC# 10

OFFICE:

IDENT#: 38212

HIGH ASSURANCE MLS WORKSTATIONS/PCs CAN BE DEVELOPED BY PORTING A B3 OR AL TRUSTED COMPUTING BASE (TCB) TO A COMMERCIAL WORKSTATION OR PC HARDWARE, AND PORTING A COMMERCIAL MAN-MACHINE INTERFACE APPLICATION TO THE TCB. THE B3/AL GEMSOS (GEMINI MULTIPROCESSING SECURE OPERATING SYSTEM) SECURITY KERNEL IS USED AS THE UNDERLYING TCB FOUNDATION IN COMPLIANCE WITH DOD STANDARD 5200.28-STD FOR COMPUTER SECURITY. GUIDELINES FOR INCREMENTALLY BUILDING MLS WORKSTATION/PC APPLICATIONS ON THE GEMSOS ARE BEING DEVELOPED USING THREE INTERFACES: GEMSOS, SECURE DOS AND SECURE UNIX. THE INTEGRATED DES ENCRYPTION WILL BE USED TO SUPPORT THE "MANDATORY CRYPTOGRAPHIC SIGNATURE" TECHNIQUE RECOMMENDED BY THE "SDI/NTB INFOSEC SECURITY STRATEGY" TO CONTROL THE VIRUS PROBLEM. TO PROVIDE

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CENTRALIZED SECURITY MANAGEMENT IN A DISTRIBUTED SECURE WORKSTATION/PC SYSTEM, AN ADAPTATION OF GEMSOS TO SUPPORT SECURE NETWORK CAPABILITIES IS BEING DEVELOPED IN COMPLIANCE WITH THE "TRUSTED NETWORK INTERPRETATION" (RED BOOK). IN A LATER EFFORT, A PROTOTYPE MLS WORKSTATION/PC WILL BE DEVELOPED WITH SECURE OFFICE AUTOMATION APPLICATIONS AND SECURE NETWORK CAPABILITIES. MANY COMMERCIAL APPLICATIONS MUST ALSO PROTECT THEIR SENSITIVE DATA AGAINST MALICIOUS SOFTWARE ATTACKS. THEIR SECURITY POLICIES MAY BE SOMEWHAT DIFFERENT FROM THAT OF DEFENSE APPLICATIONS. FOR EXAMPLE, INTEGRITY MAY BE MORE IMPORTANT THAN CONFIDENTIALITY IN SOME CASES. THE SAME GENERIC APPROACH FOR THE INCREMENTAL DEVELOPMENT OF SECURE APPLICATIONS ON THE GEMSOS TCB COULD BE ADAPTED TO SATISFY THE COMMERCIAL SECURITY REQUIREMENTS.

GENERAL PURPOSE MACHINES LAB

16 DICKENS CT

IRVINE, CA 92715

CONTRACT NUMBER:

JURN SUN LEUNG

TITLE:

INTELLIGENT JOB DISPATCHER FOR COMPUTING SYSTEMS

TOPIC# 10

OFFICE:

IDENT#: 38449

A DYNAMIC LOAD BALANCING STRATEGY IS BEING DEVELOPED FOR MULTIPROCESSOR SYSTEM BASED ON NEURAL NETWORK ARCHITECTURE. THE NEURAL NETWORK IS IMPLEMENTED AS A CENTRAL JOB DISPATCHER SYSTEM, WHERE THE INFORMATION ON THE MULTIPROCESSOR ARCHITECTURE AND PROCESSING CAPABILITY OF EACH NODE IS KNOWN. THE DISPATCHER ASSIGNS TASKS TO PROCESSORS TO OPTIMIZE THE SYSTEM PERFORMANCE AND TO MEET DEADLINE DEPENDENCY CONSTRAINTS. IN ADDITION, THE JOB DISPATCHER KEEPS TRACK OF THE OVERALL SYSTEM PERFORMANCE AND LEARNS THE NATURE OF THE LOAD BALANCING TO IMPROVE THE PERFORMANCE OF THE NEXT DECISION. INHERENT TO THE NEURAL NETWORKS IS THEIR ABILITY TO LEARN THE DYNAMICS OF THE ENVIRONMENT THEY ARE OPERATING IN THROUGH SELF-ORGANIZATION. HENCE, THE JOB DISPATCHER IS AN INTELLIGENT SYSTEM WHICH LEARNS THE PARTICULAR DISTRIBUTED COMPUTING ENVIRONMENT AND IMPROVES ITS PERFORMANCE. ANTICIPATED BENEFITS INCLUDE REAL-TIME, OPTIMIZED, FAULT-TOLERANT, DYNAMIC LOAD BALANCING FOR DEFENSE COMPUTING SYSTEMS WITH INTENSIVE TASKS SUCH AS: BATTLE MANAGEMENT,

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MULTI-TARGET ACQUISITION/TRACKING AND MULTI-WEAPON CONTROL/ALLOCATION.
IN COMMERCIAL APPLICATIONS, THE INTELLIGENT DISPATCHER WOULD RESULT
IN EFFICIENT USE OF COMPUTING RESOURCES IN BANKING, OFFICE
AUTOMATION, AND ACADEMIC RESEARCH ENVIRONMENT.

HI-Z TECHNOLOGY INC
11180 ROSELLE ST - STE G
SAN DIEGO, CA 92121
CONTRACT NUMBER:
ROBERT J CAMPANA
TITLE:
CORELESS LINEAR CONDUCTION PUMP
TOPIC# 4 OFFICE: IDENT#: 38400

A PROOF-OF-PRINCIPLE EXPERIMENT IS BEING INVESTIGATED OF A NEW KIND
OF ELECTROMAGNETIC PUMP FOR USE IN THERMOELECTROMAGNETIC PUMPS
(TEMPS). ITS EXPECTED PERFORMANCE (HYDRAULIC WATT OF PUMPING
POWER/g) IS BEING ANALYZED FOR COMPARISON WITH PERMANENT MAGNET-,
ELECTROMAGNET-, AND HELMHOLTZ COIL-, ELECTROMAGNETIC-PUMP-BASED
TEMPS. TEMPS COULD BE USED AS DECAY-HEAT-REMOVAL PUMPS AND AS MAIN
PUMPS IN NUCLEAR SPACE POWER SYSTEMS. A SERIES OF PUMP TYPES,
DEPENDING ON THE MAGNETIC FIELD PRODUCERS NOTED ABOVE, SUITABLE FOR
USE IN CONTINUOUS NUCLEAR SPACE POWER SYSTEMS OVER A POWER RANGE OF
100 kWe TO 10 MWe, HAVE BEEN STUDIED PREVIOUSLY. FEASIBILITY OF THE
PUMP CONCEPT IS BEING DETERMINED IN A LOW-COST, LOW-TECHNOLOGY
ENVIRONMENT TO MINIMIZE THE COST AND TIME NEEDED. STAINLESS STEEL -
NaK TESTLOOPS ARE BEING USED TO TEST FEASIBILITY. WHEN SUCCESSFUL,
LESS MASSIVE TEMPS WITH HIGHER SURVIVABILITY POTENTIAL WOULD RESULT.
THIS SUBJECT REPRESENTS IMPROVED COMPONENT OF SPACE POWER SYSTEMS.
BETTER SPACE POWER SYSTEMS WOULD RESULT FOR NATIONAL DEFENSE
APPLICATIONS BY PERMITTING HIGHER TEMPERATURE OPERATION, LOWER
SYSTEM MASSES, AND HIGHER SURVIVABILITY POTENTIAL. THUS, THEIR
COMMERCIAL APPLICATIONS WILL COME AS A COMPONENT OF POWER SYSTEMS
USED IN SUPPORT OF COMMERCIAL USES OF SPACE SUCH AS NEAR-ZERO
GRAVITY FABRICATION.

HMJ CORP
PO BOX 15128
CHEVY CHASE, MD 20815
CONTRACT NUMBER:
WILLIAM D JACKSON
TITLE:
DISK MAGNETOHYDRODYNAMIC CONVERSION SYSTEMS FOR NERVA REACTOR
TOPIC# 4 OFFICE: IDENT#: 38398

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THE COMBINATION OF A MAGNETOHYDRODYNAMIC (MHD) GENERATOR OF THE DISK TYPE WITH A (NERVA) REACTOR YIELDS AN ADVANCED SPACE POWER SYSTEM WITH GIGAWATT PULSE AND MEGAWATT CONTINUOUS OPERATING CAPABILITY, AT LOW SPECIFIC MASS AND HIGH SPECIFIC ENTHALPY EXTRACTION. THE NOVEL ASPECT OF THIS SYSTEM IS THE DISK MHD GENERATOR OPERATING IN THE NON-EQUILIBRIUM MODE WITH CESIUM SEEDED HYDROGEN AS THE WORKING FLUID. IN THIS STUDY, SYSTEMS AND ENGINEERING ISSUES ARE BEING INVESTIGATED IN ORDER TO COUPLE THE GENERATOR TO A NERVA HYDROGEN COOLED REACTOR. THE DISK GENERATOR OPERATING CONDITIONS REQUIRED FOR AN OPTIMIZED SYSTEM ARE BEING DETERMINED AND MODELS ARE BEING SET UP FOR THE MULTI-COMPONENT WORKING FLUID. FEASIBILITY OF NON-EQUILIBRIUM IONIZATION IN HYDROGEN IS BEING DETERMINED AND CONDITIONS FOR STABLE PLASMA BEHAVIOR ARE BEING IDENTIFIED. DESIGN OF ENGINEERING EXPERIMENTS TO OBTAIN DATA ON PLASMA BEHAVIOR AND NON-EQUILIBRIUM DISK GENERATOR OPERATION ARE ALSO BEING UNDERTAKEN. THE FEASIBILITY OF OPERATING A NON-EQUILIBRIUM MHD DISK GENERATOR WITH HYDROGEN AS THE WORKING FLUID WOULD BE ESTABLISHED FROM THIS ASSESSMENT OF THE PERFORMANCE POTENTIAL OF THE ADVANCED MULTI-MEGAWATT SPACE POWER SYSTEM COMPRISING A DISK MHD GENERATOR COUPLED TO A NERVA REACTOR. DEVELOPMENT OF A DISK GENERATOR COULD ALSO RESULT FROM A SUCCESSFUL PROGRAM FOR TERRESTRIAL MHD SYSTEMS PARTICULARLY CENTRAL STATION ELECTRIC UTILITY APPLICATIONS.

IAP RESEARCH INC
2763 CULVER AVE
DAYTON, OH 45429
CONTRACT NUMBER:
DAVID P BAUER

TITLE:

RAILGUN BORE EROSION REDUCTION

TOPIC# 2

OFFICE:

IDENT#: 38223

BORE EROSION AND DAMAGE ARE SIGNIFICANT PROBLEMS THAT LIMIT THE USEFUL LIFE OF RAILGUNS AND ARE BASICALLY RELATED TO OPERATING CURRENT DENSITY. A RAILGUN CONCEPT IS BEING INVESTIGATED THAT IS EXPECTED TO REDUCE CURRENT DENSITY BY INCREASING THE RAIL CONTACT AREA. WHEN SUCCESSFUL, RAILGUN BARREL LIFE WOULD BE EXTENDED TO A MUCH HIGHER NUMBER OF SHOTS BETWEEN REFURBISHING/REPLACEMENT. MANY

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SHOT LIFE IS ESSENTIAL FOR PRACTICAL APPLICATION OF RAILGUNS IN
WEAPON SYSTEMS.

IAP RESEARCH INC
2763 CULVER AVE
DAYTON, OH 45429
CONTRACT NUMBER:
DAVID P BAUER

TITLE:

STRAIN RATE SENSOR FOR VIBRATION CONTROL IN LARGE FLEXIBLE
STRUCTURES

TOPIC# 12

OFFICE:

IDENT#: 38403

A TRANSDUCER WHICH CAN DIRECTLY MEASURE THE TIME RATE OF CHANGE OF
STRAIN (STRAIN RATE) IN A VIBRATING STRUCTURE IS BEING DEVELOPED.
THERE ARE PRESENTLY NO TRANSDUCERS AVAILABLE THAT CAN PRODUCE THIS
STRAIN RATE INFORMATION. THIS HAS CREATED DIFFICULTIES IN VIBRATION
CONTROL BECAUSE ACTIVE CONTROL CANNOT SIGNIFICANTLY AFFECT STRUCTURAL
DAMPING UNLESS RATE-OF-CHANGE DATA IS ONE OF THE STRUCTURAL CONTROL
FEEDBACK VARIABLES. THE TRANSDUCER DEVELOPED ON THIS PROGRAM, THE
VARIABLE RELUCTANCE TRANSFORMER (VRT) STRAIN RATE SENSOR, IS A
SMALL FLAT TRANSFORMER THAT MOUNTS DIRECTLY TO A STRUCTURE MUCH LIKE
A CONVENTIONAL STRAIN GAUGE. SUCCESSFUL DEVELOPMENT OF THE REAL-TIME
STRAIN RATE SENSOR ALLOWS THE MOTION OF LARGE SPACE STRUCTURES TO BE
MEASURED MORE DIRECTLY; AND PERMITS MORE EFFECTIVE AND LIGHTER WEIGHT
ACTIVE STRUCTURAL CONTROL SYSTEMS FOR MILITARY AND COMMERCIAL SPACE
PLATFORMS.

IBIS TECHNOLOGY CORP
32A CHERRY HILL DR
DANVERS, MA 01923
CONTRACT NUMBER:
DR BERNARD CORDTS

TITLE:

OPTIMUM IMPLANT TEMPERATURE DETERMINATION FOR SIMOX MATERIAL

TOPIC# 14

OFFICE:

IDENT#: 38226

SELECTION OF THE PROPER SIMOX MATERIAL IMPLANT TEMPERATURE, COMBINED

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WITH OPTIMUM ANNEAL CONDITIONS, ENABLES THE HIGHEST QUALITY SIMOX MATERIAL TO BE PRODUCED. SINCE OPTIMUM ANNEALING CONDITIONS HAVE RECENTLY BEEN ESTABLISHED, THIS PROGRAM EVALUATES THE OPTIMUM IMPLANT TEMPERATURE FOR SIMOX. SIMOX MATERIAL CAN BE PRODUCED MORE ECONOMICALLY AT HIGHER IMPLANT TEMPERATURE; IT IS THEREFORE, CRUCIAL TO ESTABLISH THE HIGHEST IMPLANT TEMPERATURE POSSIBLE. HOWEVER, THE RETENTION OF ABSORBED OXYGEN THERMAL DONORS IN THE SUPERFICIAL SILICON LAYER MAY LIMIT THE MAXIMUM IMPLANT TEMPERATURE USED. ANALYTICAL TECHNIQUES WHICH CAN MEASURE OXYGEN LEVELS BELOW THE SIMS LIMIT ARE ALSO BEING INVESTIGATED IN THIS STUDY. APPLICATIONS INCLUDE MATERIAL FOR GOVERNMENT SPECIFIED RADIATION HARDENED CMOS AND BIPOLAR CIRCUITRY.

INTEGRATED SYSTEMS INC
2500 MISSION COLLEGE BLVD
SANTA CLARA, CA 95054
CONTRACT NUMBER:
DR MINJEA TAHK
TITLE:

INTERCEPTING ACCELERATING BOOSTERS AND REENTRY VEHICLES WITHOUT RANGE MEASUREMENTS

TOPIC# 2 OFFICE: IDENT#: 38414

A DUAL-CONTROL SCHEME FOR COUPLED TARGET STATE ESTIMATION AND KINETIC ENERGY WEAPON GUIDANCE IS BEING INVESTIGATED. STATE ESTIMATION AND GUIDANCE FUNCTIONS ARE BEING INTEGRATED TO PROVIDE ADEQUATE OBSERVABILITY OF THE TARGET STATES WHERE MEASUREMENT OF RANGE MAGNITUDE IS NOT AVAILABLE, SUCH AS WHEN A PASSIVE INFRARED FOCAL PLANE ARRAY SENSOR IS USED TO TRACK THE TARGET LINE OF SIGHT. THE GUIDANCE SCHEME IS REQUIRED TO MINIMIZE THE EXPECTED MISS DISTANCE SUBJECT TO A KNOWN BOUND ON AVAILABLE DIVERT PROPELLANT; MANEUVERING REDUCES THE UNCERTAINTY IN THE TARGET STATE ESTIMATES. A NEW SOPHISTICATED FORM OF KALMAN FILTER, IS INTRODUCED AND INTEGRATED INTO THE DUAL-CONTROL SCHEME; THE TARGET MODEL IS BEING SUBJECTED TO KINEMATIC CONSTRAINTS. THIS SCHEME IS EXPECTED TO SHOW SUPERIOR ACCURACY IN ESTIMATION OF RANGE FROM ANGLES-ONLY MEASUREMENTS. WHEN SUCCESSFUL, THE PRINCIPAL BENEFIT WILL BE A REDUCTION IN COST OF KINETIC ENERGY WEAPONS DUE TO ELIMINATION OF THE NEED TO ACTIVELY MEASURE RANGE FROM THE KEW TO THE TARGET. A HOST OF ADDITIONAL

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APPLICATIONS WILL BE MADE POSSIBLE.

IOWA LASER TECHNOLOGY INC
6122 NORDIC DR
CEDAR FALLS, IA 50613
CONTRACT NUMBER:
MARK W BALDWIN

TITLE:

LASER CHEMICAL VAPOR DEPOSITION GROWTH OF DIAMOND THIN FILMS ON
ELECTRONIC MATERIAL SUBSTRATES

TOPIC# 14 OFFICE: IDENT#: 38417

LASER CHEMICAL VAPOR DISPOSITION (LCVD)-PROCESSED FILMS ARE EXPECTED TO BE SUPERIOR TO THOSE PROCESSED WITH PLASMA CVD AND ION BEAM METHODS BECAUSE LCVD PROVIDES HIGH DEPOSITION RATE, HIGH PURITY FILMS, LOCALIZED DEPOSITION, FINE GRAIN SIZE, HIGH SPATIAL RESOLUTION, LOW SUBSTRATE TEMPERATURES, AND EXCELLENT PROCESS CONTROLLABILITY. IN THIS PROJECT, ELECTRONIC MATERIAL SUBSTRATES OF THE TYPE GaAs AND InP ARE BEING DEPOSITED WITH DIAMOND THIN FILMS USING LCVD. BOTH PYROLYSIS AND PHOTOLYSIS MODES OF LASER DEPOSITION FORM A MIXTURE OF CH₄ AND H₂ OR C₂H₂ AND H₂ ARE BEING UTILIZED USING UV/IR LASER BEAMS. THE POTENTIAL APPLICATIONS OF THIS PROJECT ARE: A RAPID METHOD OF DEPOSITION OF HIGH PERFORMANCE DIAMOND FILMS ON A LARGE VARIETY OF OPTOELECTRONIC COMPONENTS; SOLID STATE OPTICAL SWITCHES; LARGE AREA HEAT SINKS FOR ELECTRONICS; WEAR RESISTANT SURFACES FOR CUTTING TOOLS; ROCK DRILLS AND STAMPING PUNCHES; AND ANTIREFLECTION AND PROTECTIVE COATINGS.

IRVINE SENSORS CORP
3001 REDHILL AVE - BLDG 3/STA 208
COSTA MESA, CA 92626
CONTRACT NUMBER:
RONALD J INDIN

TITLE:

LASER HETERODYNE INFRARED MOSAIC RECEIVER

TOPIC# 2 OFFICE: IDENT#: 38236

DOPPLER IMAGING OF A ROTATING OBJECT CAN BE A POWERFUL MEANS OF

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DISCRIMINATION, TRACKING, AND AIMPOINT DETERMINATION. SIMULTANEOUS DOPPLER IMAGING OF MULTIPLE TARGETS AND DECOYS REQUIRES TWO-DIMENSIONAL ARRAYS OF LASER HETERODYNE RECEIVERS, WHICH, UNTIL NOW, HAS BEEN IMPRACTICAL DUE TO POWER AND BANDWIDTH CONSIDERATIONS. THE INTEGRATION OF JOSEPHSON JUNCTION (JJ) HIGH-SPEED, LOW-POWER SUPERCONDUCTING TECHNOLOGY WITH 3-D COMPLEMENTARY METAL OXIDE SEMICONDUCTOR (CMOS) INFRARED (IR) FOCAL PLANE TECHNOLOGY PROVIDES THE OPPORTUNITY TO OVERCOME THESE DIFFICULTIES AND TO COMBINE IMAGING LASER HETERODYNE DETECTION WITH CONVENTIONAL LONG WAVELENGTH INFRARED (LWIR) IMAGING IN A MULTI-MODE SENSOR. THE USE OF JJ TECHNOLOGY IS BEING INVESTIGATED TO PROVIDE SUFFICIENT BANDWIDTH TO PERFORM THIS DOPPLER IMAGING CAPABILITY WITHIN THE AREA AND POWER BUDGETS ALLOCATED IN THE TYPICAL KEW SCENARIO. DURING A LATER STUDY, A HARDWARE BREADBOARD OF THE PRIMARY CIRCUIT FUNCTIONS WILL BE DESIGNED, FABRICATED, AND TESTED TO PROVE THE COMPATIBILITY OF JJ AND CMOS TECHNOLOGIES. WHEN SUCCESSFUL, POTENTIAL BENEFITS INCLUDE: IR DOPPLER IMAGING FOR DISCRIMINATION; PASSIVE HETERODYNE DETECTION OF LINE EMITTING TARGETS, INCLUDING MISSILES, AIRCRAFT, AND LASER DESIGNATORS; ROOM TEMPERATURE IR OPERATION; WIDE FIELD ACQUISITION AND TRACKING OF MULTIPLE TARGETS; AND, CLUTTER ELIMINATION.

ISOTHERMAL SYSTEMS RESEARCH
PO BOX 185 - 219 BIG RUN RD #2
LEXINGTON, KY 40584
CONTRACT NUMBER:
DONALD E TILTON

TITLE:

HEAT EXCHANGER CONCEPTS SUITABLE FOR MICROGRAVITY CONDENSERS
TOPIC# 7 OFFICE: IDENT#: 38237

A FEASIBILITY STUDY IS BEING PERFORMED OF TWO HEAT EXCHANGER CONCEPTS SUITABLE FOR MICROGRAVITY CONDENSERS. A THEORETICAL STUDY IS BEING CONDUCTED TO DETERMINE THE EFFECTIVENESS OF EACH EXCHANGER DESIGN WHEN INTEGRATED INTO AN ACTUAL APPLICATION. SPECIFICALLY, HEAT EXCHANGERS ARE BEING CONSIDERED WHICH ARE USED TO CONDENSE THE COMBUSTION PRODUCT LEAVING THE HYDROGEN/OXYGEN TURBOGENERATOR IN THE SPACE-BASED NEUTRAL PARTICLE BEAM WEAPONS PLATFORM USING EXCESS ON-BOARD HYDROGEN. THE DESIGN IS BEING SCALED TO AN EXPERIMENTAL LEVEL FOR CONCEPT DEMONSTRATION, USING NITROGEN INSTEAD OF HYDROGEN. THIS

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FIRST DESIGN IS OF A DIRECT CONTACT HEAT EXCHANGER WHICH INCORPORATES A CENTRIFUGAL SEPARATOR TO REMOVE THE CONDENSATE FROM THE CRYOGEN VAPOR FLOW. THE SECOND DESIGN IS OF A SHELL AND TUBE HEAT EXCHANGER WHICH USES GREGORIG GROOVES TO ENHANCE THE CONDENSATION HEAT TRANSFER COEFFICIENT AND PROVIDES FLUID TRANSPORT ARTERIES FOR CONDENSATE REMOVAL. THIS RESEARCH IS IDENTIFYING A HEAT EXCHANGER DESIGN SUITABLE FOR USE IN THE SPACE-BASED NEUTRAL PARTICLE BEAM WEAPONS PLATFORM. THE COMBUSTION PRODUCT FROM THE POWER GENERATION CANNOT BE DUMPED IN SPACE. THEREFORE, THIS TYPE OF HEAT EXCHANGER IS VITAL TO THE DEVELOPMENT OF THE PLATFORM. THE HEAT EXCHANGER AND THE REQUIRED EXCESS HYDROGEN CONSTITUTE A SIGNIFICANT PORTION OF THE PLATFORM WEIGHT NECESSITATING THE DEVELOPMENT OF A VERY EFFICIENT DEVICE. THE TYPES OF HEAT EXCHANGERS BEING INVESTIGATED MAY ALSO BE USEFUL TO CONDENSE THE STEAM GENERATED BY QUENCHING IN SPACE-BASED MATERIALS PROCESSING. NON-CONDENSABLE GASES USED IN THE PROCESSES MAY ALSO NEED TO BE SEPARATED FROM THE CONDENSATE.

JAMAR TECHNOLOGY CO
3956 SORRENTO VALLEY BLVD
SAN DIEGO, CA 92121
CONTRACT NUMBER:
DR HARRY SHIELDS
TITLE:
PHOTO-EMISSIVE CATHODES FOR HIGH ENERGY ELECTRON BEAMS
TOPIC# 1 OFFICE: IDENT#: 38247

IN THIS STUDY, THE FEASIBILITY OF USING PHOTO-EMISSIVE CATHODES FOR THE GENERATION OF HIGH ENERGY ELECTRON BEAMS IS BEING DETERMINED. A TEST EXPERIMENT IS BEING CONDUCTED TO GENERATE ELECTRON BEAM PULSES OF 100KV ENERGY, CONTROLLED BY PHOTO-IRRADIATION. LATER EFFORTS WOULD INVESTIGATE SCALING TO HIGHER VOLTAGES AND LARGER AREAS, AND WOULD FURTHER STUDY BEAM UNIFORMITY. DEVELOPMENT OF PHOTO-EMISSIVE CATHODES COULD PROVIDE IMPROVED RELIABILITY AND HIGHER REPETITION RATES FOR ELECTRON-BEAM PUMPED HIGH ENERGY LASERS. OTHER APPLICATIONS OF THIS TECHNOLOGY INCLUDE LONG LIFE, UNIFORM FLOW, HIGH EMITTANCE ELECTRON SOURCES FOR USE IN FREE ELECTRON LASERS, AND PARTICLE BEAM DEVICES.

KOPIN CORP
695 MYLES STANDISH BLVD
TAUNTON, MA 02780
CONTRACT NUMBER:
DR PAUL M ZAVRACKY
TITLE:
SMART MICROSENSORS FOR HIGH TEMPERATURE APPLICATIONS
TOPIC# 14 OFFICE: IDENT#: 38429

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RECENT ADVANCES IN MICROSENSOR TECHNOLOGY HAVE PRODUCED SMALLER, MORE ECONOMICAL SENSORS FOR INTERNAL COMBUSTION ENGINE APPLICATIONS. WITH THESE SMALL SENSORS A NEED ALSO EXISTS FOR MINIATURIZED SIGNAL CONDITIONING ELECTRONICS IN CLOSE PROXIMITY TO THE SENSOR. THIS PROJECT ADDRESSES THE DEVELOPMENT OF SMART MICROSENSORS FOR APPLICATIONS UNDER HIGH TEMPERATURE AMBIENTS (UP TO 350 C). THE USEFULNESS OF SILICON-ON-INSULATOR (SOI) MATERIAL PRODUCED BY THE ISOLATED SILICON EPITAXY (ISE) PROCESS WILL BE DEMONSTRATED. ANOTHER EFFORT WILL STUDY PROCESS DEVELOPMENT OF SENSOR ELEMENTS. THE USE OF SOI MATERIAL OFFERS MANY ADVANTAGES OVER CONVENTIONAL BULK SILICON WAFERS, INCLUDING RADIATION HARDNESS, VOLTAGE ISOLATION, IMPROVED SPEED, AND HIGH TEMPERATURE OPERATION. THESE ADVANTAGES MAY BE EXPLOITED IN THE DEVELOPMENT OF A NEW CLASS OF MICROSENSORS. MICROSENSORS CAPABLE OF HIGH TEMPERATURE OPERATION OFFER A WIDE RANGE OF APPLICATIONS SUCH AS AIRCRAFT AND AUTOMOTIVE ENGINE MOTORS, SENSORS FOR ROCKET AND MISSILE NOZZLES, AND PROCESS CONTROL SENSORS FOR MICROELECTRONICS FABRICATION.

LINEAR MONOLITHICS INC
660 HAMPSHIRE RD - STE 212
WESTLAKE VILLAGE, CA 91361

CONTRACT NUMBER:

ROBERT E LEE

TITLE:

BANDGAP-ENGINEERED 80 NANOMETER GATE PSEUDOMORPHIC GaInAs/InP 200 GIGA-HERTZ TRANSISTORS

TOPIC# 14

OFFICE:

IDENT#: 38441

THE OBJECTIVE OF THIS PROGRAM IS TO DESIGN, BUILD, AND TEST PSEUDOMORPHIC InP HIGH ELECTRON MOBILITY TRANSISTORS (HEMTs). THIS WORK IS AN EXTENSION OF CURRENT EFFORTS TO DEVELOP PSEUDOMORPHIC HEMTs ON GaAs. BUILDING UPON EXISTING ANALYTICAL FABRICATIONAL EXPERTISE, THE GOAL IS TO DEMONSTRATE WORKING, ULTRA-HIGH PERFORMANCE, PSEUDOMORPHIC HEMTs WITH GATE LENGTH OF 80 NANOMETERS (800 ANGSTROMS). ALSO, BY USING SUITABLE MICROWAVE AND MILLIMETER-WAVE TECHNIQUES THE DEVICES' F-- WIL BE MEASURED. ANTICIPATED BENEFITS OF PSEUDOMORPHIC (GAAS) HEMTs INCLUDE LOWER NOISE, HIGH DYNAMIC RANGE, AND WIDER BANDWIDTH. SUCCESSFUL DEVELOPMENT OF SUCH

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A DEVICE COULD YIELD PRACTICAL MILLIMETER-WAVE RADAR'S AND IMAGING SYSTEMS, SMALLER, LIGHTER WEIGHT MICROWAVE AND MILLIMETER-WAVE SYSTEMS AS WELL AS IMPROVED SATELLITE COMMUNICATIONS AND REMOTE SENSING SYSTEMS.

LITHIUM ENERGY ASSOCS

246 SYCAMORE ST
WATERTOWN, MA 02172

CONTRACT NUMBER:
FREDERICK DAMPIER

TITLE:

HIGH POWER LITHIUM RECHARGEABLE BATTERIES WITH INORGANIC ELECTROLYTES

TOPIC# 5

OFFICE:

IDENT#: 38445

THE PERFORMANCE OF SEVERAL RECHARGEABLE LITHIUM/INORGANIC ELECTROLYTE BATTERY SYSTEMS IS BEING EVALUATED DURING HIGH POWER PULSE DISCHARGE CONDITIONS SUITABLE FOR STRATEGIC DEFENSE APPLICATIONS. LITHIUM/INORGANIC ELECTROLYTE CELLS SUCH AS THE Li/CuCl₂ CELL USING SO₂ BASED ELECTROLYTES HAVE BEEN FOUND TO GIVE EXCELLENT CYCLE LIFE AND ENERGY DENSITIES (E.G. 200 CYCLES AT 75 Whr/lb) BUT HAVE NOT BEEN EVALUATED OR DEVELOPED FOR HIGH POWER PULSE DISCHARGE CYCLING. THE HIGH ELECTRICAL CONDUCTIVITY OF SEVERAL INORGANIC ELECTROLYTES AND THE UNUSUAL POSITIVE ELECTRODE REDUCTION MECHANISM SUGGESTS THAT Li/INORGANIC ELECTROLYTE CELLS MAY GIVE OUTSTANDING PERFORMANCE. IN THIS STUDY, THE HIGH POWER PERFORMANCE OF SEVERAL PROMISING NEW POSITIVE ELECTRODE MATERIALS IS BEING EVALUATED AND CELL DESIGN IS BEING IMPROVED. POSITIVE ELECTRODE TECHNOLOGY IS BEING DEVELOPED TO INCREASE THE HIGH CURRENT CAPABILITIES OF THE BEST ELECTROCHEMICAL SYSTEM. THIS PROJECT, WHEN SUCCESSFUL, COULD HAVE POTENTIAL FOR TERRESTRIAL RAIL GUN, LASER AND SIMILAR WEAPON SYSTEMS IN ADDITION TO THE SPACE POWER APPLICATION. THE TECHNOLOGY WOULD IMPROVE THE HIGH RATE CONTINUOUS DISCHARGE PERFORMANCE OF Li/INORGANIC ELECTROLYTE RECHARGEABLE CELLS. THUS, IT WOULD BENEFIT POTENTIAL COMMERCIAL APPLICATIONS SUCH AS LOW EARTH ORBIT SATELLITE POWER, CELLULAR RADIOS AND IMPLANTABLE ELECTROMEDICAL DEVICES SUCH AS HEART DEFIBRILLATORS.

MAINSTREAM ENGINEERING CORP

200 YELLOW PL
ROCKLEDGE, FL 32955

CONTRACT NUMBER:
ROBERT P SCARINGE

TITLE:

MICRO-GRAVITY COMPRESSOR AND LUBRICATION SYSTEM

TOPIC# 7

OFFICE:

IDENT#: 38451

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A MICRO-GRAVITY COMPRESSOR IS BEING INVESTIGATED AS PART OF A SPACECRAFT THERMAL-MANAGEMENT/THERMAL-TRANSPORT SYSTEM. INCREASINGLY STRINGENT THERMAL REQUIREMENTS ARE PROJECTED FOR FUTURE SPACECRAFT. COMPLIANCE WITH THESE REQUIREMENTS NECESSITATES THE DEVELOPMENT OF THERMAL CONTROL TECHNIQUES WITH CAPABILITIES FAR EXCEEDING THOSE IN CURRENT USE. A FUNDAMENTAL CONSIDERATION IS A HEAT TRANSPORT AND THERMAL REJECTION SYSTEM CAPABLE OF ACCOMMODATING LARGE HEAT LOADS, HIGH ENERGY DENSITIES, LONG TRANSPORT DISTANCES, VARIABLE DUTY CYCLES, AND VARYING OPERATIONAL PARAMETERS. PREVIOUS EFFORTS HAVE INDICATED SIGNIFICANT BENEFITS IN TERMS OF REDUCTIONS IN SYSTEM MASS (2-28%), COMPLEXITY, AND RADIATOR AREA (28-58%) THAT ARE POSSIBLE WITH HEAT PUMP LOOP (HPL) THERMAL MANAGEMENT SYSTEM IS BEING INVESTIGATED. BENEFITS OF THE CENTRIFUGAL COMPRESSOR AND LUBRICATION SYSTEM ARE BEING DETERMINED. THIS EFFORT IS EXPECTED TO RESULT IN A PRELIMINARY DESIGN OF THE COMPRESSOR/LUBRICATION SYSTEM FOR THE HPL SYSTEM.

MAINSTREAM ENGINEERING CORP
200 YELLOW PL
ROCKLEDGE, FL 32955
CONTRACT NUMBER:
ROBERT P SCARINGE
TITLE:
MICRO-GRAVITY EVAPORATOR AND CONDENSER CONCEPTS
TOPIC# 7 OFFICE: IDENT#: 38452

EVAPORATIVE ELECTRONIC COLD PLATE AND SHEAR FLOW CONDENSER DESIGNS ARE BING INVESTIGATED AS PART OF SPACECRAFT THERMAL-MANAGEMENT/THERMAL-TRANSPORT SYSTEM. INCREASINGLY STRINGENT THERMAL REQUIREMENTS ARE PROJECTED FOR FUTURE SPACECRAFT. COMPLIANCE WITH THESE REQUIREMENTS NECESSITATES THE DEVELOPMENT OF THERMAL CONTROL TECHNIQUES WITH CAPABILITIES FAR EXCEEDING THOSE IN CURRENT USE. A FUNDAMENTAL CONSIDERATION IS A HEAT TRANSPORT AND THERMAL REJECTION SYSTEM CAPABLE OF ACCOMMODATING LARGE HEAT LOADS, HIGH ENERGY DENSITIES, LONG TRANSPORT DISTANCE, VARIABLE DUTY CYCLES, AND VARYING OPERATIONAL PARAMETERS. PREVIOUS EFFORTS HAVE INDICATED SIGNIFICANT BENEFITS IN REDUCTION OF SYSTEM MASS (2-28%), COMPLEXITY, AND RADIATOR AREA (28-58%) THAT ARE POSSIBLE WITH THE HEAT PUMP LOOP

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(HPL) THERMAL MANAGEMENT SYSTEM BEING INVESTIGATED. BENEFITS OF THE EVAPORATIVE ELECTRONIC COLD PLATE ASSEMBLY ARE BEING DETERMINED. THIS EFFORT IS EXPECTED TO RESULT IN A PRELIMINARY DESIGN OF THE MICRO-GRAVITY EVAPORATE ELECTRONIC COLD PLATE AND CONDENSER.

MAINSTREAM ENGINEERING CORP
200 YELLOW PL
ROCKLEDGE, FL 32955
CONTRACT NUMBER:
DR ROBERT P SCARINGE
TITLE:
SPACECRAFT THERMAL STORAGE DEVICE
TOPIC# 7 OFFICE: IDENT#: 38453

A STORAGE TECHNIQUE CAPABLE OF STORING UP TO 408 kJ/kg IS BEING INVESTIGATED. THIS STORAGE TECHNIQUE WOULD BE INCORPORATED DIRECTLY INTO THE HEAT PUMP USED FOR AUGMENTING SPACECRAFT HEAT REJECTION AND COULD BE INCORPORATED INTO A SPACECRAFT THERMAL-MANAGEMENT/THERMAL-TRANSPORT SYSTEM. IN THIS EFFORT, BENEFITS ARE BEING EVALUATED OF THE CHEMICAL STORAGE TECHNIQUE THAT COULD BE INCORPORATED INTO THE VAPOR COMPRESSION HEAT PUMP SYSTEM. THIS EFFORT IS EXPECTED TO YIELD A PRELIMINARY DESIGN OF THE STORAGE ASSEMBLY, AS WELL AS THE RESULTS OF SEVERAL BASIC EXPERIMENTS TO DEMONSTRATE THE SYSTEM. CRITICAL TASKS TO BE PERFORMED DURING A LATER EFFORT ARE ALSO BEING IDENTIFIED. PREVIOUS EFFORTS HAVE INDICATED THE SIGNIFICANT BENEFITS IN REDUCTION OF SYSTEM MASS (2-28%), COMPLEXITY, AND RADIATOR AREA (28-58%) THAT ARE POSSIBLE WITH THE HEAT PUMP LOOP (HPL) THERMAL MANAGEMENT SYSTEM. WHEN SUCCESSFUL, THE CHEMICAL STORAGE SYSTEM COULD BE INCORPORATED INTO THE VAPOR COMPRESSION HEAT PUMP SYSTEM AND PROVIDE SIGNIFICANT THERMAL STORAGE CAPABILITY (408 kJ/kg).

MATERIALS MODIFICATION INC
2946 SLEEPY HOLLOW RD - STE 2H
FALLS CHURCH, VA 22044
CONTRACT NUMBER:
DR T S SUDARSHAN
TITLE:
DIAMOND THIN FILM SYNTHESIS BY LASER CHEMICAL VAPOR DEPOSITION
FOR SPACE APPLICATIONS
TOPIC# 13 OFFICE: IDENT#: 38464

SUBMITTED BY

THIS STUDY IS INVESTIGATING THE USE OF LASER-INDUCED CHEMICAL VAPOR DEPOSITION (LCVD) TECHNIQUES TO DEPOSIT DIAMOND THIN FILMS ON OPTICAL SUBSTRATES. THE PROGRAM APPROACH IS TO USE BOTH CONTINUOUS WAVE (CE) CO2 AND PULSED EXCIMER LASERS TO SYNTHESIZE PHOTO-PYTOLYSIS MECHANISMS. A DUAL BEAM CONCEPT IS BEING IMPLEMENTED TO ACHIEVE THE DESIRED FILM CHARACTERISTICS, LCVD-PROCESSED FILMS OFFER HIGH DEPOSITION RATE, HIGH PURITY FILMS, LOCALIZED DEPOSITION, FINE GRAIN SIZE, HIGH SPATIAL RESOLUTION, LOW SUBSTRATE TEMPERATURES, AND EXCELLENT CONTROLLABILITY OF THE PROCESS. ANALYTICAL INSTRUMENTATION SUCH AS SCANNING ELECTRON MICROSCOPY, ELECTRON AND X-RAY DIFFRACTION AND RAMAN SPECTROSCOPY IS BEING USED TO CHARACTERIZE THE FILMS. SOME APPLICATIONS INCLUDE COATINGS FOR OPTICAL COMPONENTS USED IN SPACE SHIELDS, IR SENSOR SHIELDS, LASER OPTICS, IR FOCAL PLANE SUBSTRATE COATINGS, WEAR RESISTANT SURFACES IN CUTTING TOOLS, AND ANTIREFLECTION AND PROTECTIVE COATINGS.

MATERIALS SCIENCES CORP
GWYNEDD PLAZA II - BETHLEHEM PIKE
SPRING HOUSE, PA 19477
CONTRACT NUMBER:
KENT W BUESKING
TITLE:
FIBER REINFORCED GLASS COMPOSITE STRUCTURAL DEVELOPMENT
TOPIC# 13 OFFICE: IDENT#: 38472

GLASS MATRIX COMPOSITE MATERIAL PERFORMANCE DEPENDS UPON MATRIX STRESSES GENERALLY IGNORED IN POLYMER MATRIX COMPOSITES; HENCE THE NEED FOR NEW DESIGN METHODOLOGY. IN THIS PROGRAM, A DESIGN METHODOLOGY FOR GLASS COMPOSITE STRUCTURES IS DEMONSTRATED. A DESIGN DATABASE OF REALISTIC MATERIAL PROPERTIES WILL BE ANALYZED USING MICROMECHANICS AND COMPOSITE MATERIAL MODELS TO DEVELOP A FUNDAMENTAL UNDERSTANDING OF THE REINFORCEMENT AND MATRIX INTERACTIONS. USING THIS DATABASE, STRUCTURAL COMPONENTS CAN THEN BE DESIGNED TO DEMONSTRATE THE BENEFITS OF FIBER REINFORCED GLASS COMPOSITES AND THE PRACTICALITY OF THE NEW DESIGN METHODOLOGY. THE SELECTION PROCESS INCLUDES DEFINITION OF THE DESIGN CONSTRAINTS, AND STRUCTURAL ANALYSIS OF A RANGE OF COMPOSITE CONSTRUCTIONS AND STRUCTURAL GEOMETRIES FOR EACH COMPONENT. THREE SPECIFIC COMPONENT DESIGNS WILL

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BE RECOMMENDED FOR FURTHER DEVELOPMENT AND TESTING. THE LIGHTWEIGHT HIGH TEMPERATURE CHARACTERISTICS OF GLASS MATRIX COMPOSITES WILL BE USEFUL IN AIRFRAMES, HIGH TEMPERATURE LIGHTWEIGHT ENGINE COMPONENTS, IMPROVED BEARINGS AND SEALS, AND FIRE RESISTANT STRUCTURES.

MATERIALS SCIENCES CORP
GWYNEDD PLAZA II - BETHLEHEM PIKE
SPRING HOUSE, PA 19477
CONTRACT NUMBER:
KENT W BUESKING
TITLE:
MICROSTRUCTURALLY TOUGHENED METAL MATRIX COMPOSITES
TOPIC# 13 OFFICE: IDENT#: 38474

MICROSTRUCTURALLY TOUGHENED METAL MATRIX COMPOSITES INCORPORATE TOUGHENING MECHANISMS RESULTING IN INCREASED MATERIAL DAMAGE TOLERANCE. WITH AN OPTIMIZED DESIGN, THIS MATERIAL CAN ACHIEVE GREATER IMPACT ENERGY ABSORPTION CAPABILITY BY PERMITTING THE GREATEST AMOUNT OF MATERIAL TO DEFORM DURING THE FAILURE PROCESS. IN THIS STUDY, A DESIGN METHODOLOGY FOR MICROSTRUCTURALLY TOUGHENED COMPOSITES IS DEMONSTRATED. A DESIGN DATABASE OF REALISTIC MATERIAL PROPERTIES IS BEING ANALYZED USING MICROMECHANICS AND COMPOSITE MATERIAL MODELS TO DEVELOP A FUNDAMENTAL UNDERSTANDING OF THE TOUGHENING MECHANISMS. STRUCTURAL COMPONENTS ARE BEING DESIGNED TO DEMONSTRATE THE BENEFITS OF MICROSTRUCTURALLY TOUGHENED COMPOSITES AND THE PRACTICALITY OF THE NEW DESIGN METHODS. THIS PROCESS INCLUDES DEFINITION OF THE DESIGN CONSTRAINTS, AS WELL AS STRUCTURAL ANALYSIS OF A RANGE OF COMPOSITE CONSTRUCTIONS AND STRUCTURAL GEOMETRIES FOR EACH COMPONENT. THREE SPECIFIC COMPONENT DESIGNS WILL BE RECOMMENDED FOR FURTHER DEVELOPMENT AND TESTING. IMPROVED MATERIAL IMPACT ABSORPTION CAPABILITY OFFERS COMPOSITE AIRCRAFT ENGINE COMPONENT AND AIRFRAME AND AUTOMOTIVE APPLICATIONS BETTER STRUCTURAL RELIABILITY.

MATERIALS TECHNOLOGIES CORP
57 MARYANNE DR
MONROE, CT 06468
CONTRACT NUMBER:
DR YOGESH MEHROTRA
TITLE:
HIGH PERFORMANCE MOLYBDENUM SILICIDE/SILICON CARBIDE LAMINATE COMPOSITES
TOPIC# 13 OFFICE: IDENT#: 38476

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IN THIS PROGRAM, TECHNOLOGY IS BEING DEVELOPED FOR FABRICATING HIGH TEMPERATURE, HIGH OXIDATION RESISTANT MOLYBDENUM SILICATE/SILICON CARBIDE (MoSi_2/SiC) LAMINATE CERAMIC STRUCTURES VIA A SCALABLE CHEMICAL VAPOR DEPOSITION (CVD) PROCESS. SMALL SAMPLES OF A SiC LAMINATE COMPOSITE ARE BEING FABRICATED BY DEPOSITING ALTERNATE LAYERS OF SiC AND MoSi_2 SO THAT LARGE COMPRESSIVE STRESSES ARE PRODUCED ON THE COMPOSITE SURFACE. THE COMPOSITE MATERIAL IS THEN BEING CHARACTERIZED FOR DENSITY, HARDNESS, FLEXURAL STRENGTH, FRACTURE TOUGHNESS, AND THERMAL EXPANSION COEFFICIENT. ANALYTICAL UNDERSTANDING OF THE LAMINATE COMPOSITE AND THE CVD PROCESS PARAMETERS IS ALSO BEING DEVELOPED TO PROVIDE PROCESS SCALING TO LARGE SIZED AND TO OTHER MATERIALS. WHEN SUCCESSFUL, THIS RESEARCH COULD BE EXPANDED TO THE FABRICATION OF TOUGHENED SiC COATINGS FOR CARBON-CARBON COMPOSITES, HIGH STRENGTH SiC GRATINGS, HEAT PIPES, COMPONENTS FOR DIFFUSION FURNACES, LARGE AREA MIRRORS, HIGH POWER BEAM CONCENTRATORS AND DEFLECTORS, OPTICS FOR HIGH ENERGY LASERS, LIDARS, AND ASTRONOMICAL TELESCOPES.

MICROWAVE TECHNOLOGY INC

4268 SOLAR WY

FREMONT, CA 94538

CONTRACT NUMBER:

ADRIAN I COGAN

TITLE:

SOLID STATE TRIODE TRANSISTOR FOR MICROWAVE POWER GENERATION

TOPIC# 14

OFFICE:

IDENT#: 38489

THE OBJECTIVE OF THIS EFFORT IS TO DEVELOP HIGH POWER, HIGH VOLTAGE MICROWAVE TRANSISTORS THAT WILL EXCEED THE CURRENT PERFORMANCE LEVELS. THE NEW TRANSISTORS, CALLED "SOLID STATE TRIODE" OR SST, IS INHERENTLY RADIATION HARD AND EXTREMELY RUGGED. THE TRANSISTOR, WHICH SIMULTANEOUSLY EXHIBITS HIGH FREQUENCY AND HIGH VOLTAGE CAPABILITIES, IS ATTRACTIVE FOR VERY HIGH POWER MICROWAVE APPLICATIONS SUCH AS THE NEUTRAL PARTICLE BEAM GENERATOR. AS TRANSISTOR BREAKDOWN VOLTAGE IS INCREASED, THE SYSTEM CURRENTS DECREASES, AND IMPEDANCE MATCHING CIRCUITRY IS SIMPLIFIED, WHILE POWER LOSSES AND WEIGHT ALSO DECREASE. THIS PROJECT DEMONSTRATES THE FEASIBILITY OF SST DEVICES WITH BREAKDOWN VOLTAGES IN EXCESS OF

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150V, CUTOFF FREQUENCIES OVER 4 GHz, AND CW POWER RATINGS AS HIGH AS 300 WATTS; ALL WELL BEYOND THE PRESENT STATE OF THE ART. IF SUCCESSFUL, THE SST COULD GRADUALLY REPLACE SILICON BIPOLAR AND MOS POWER TRANSISTORS. IT IS SUITABLE FOR VIRTUALLY ALL POWER AND HIGH POWER APPLICATIONS IN CONSUMER, INDUSTRIAL, MEDICAL, AND MILITARY SYSTEMS WHERE SILICON TRANSISTORS AND VACUUM TUBES ARE CURRENTLY USED. POTENTIAL APPLICATIONS INCLUDE GROUND, AIRBORNE, AND SPACE SYSTEMS.

MISSION RESEARCH CORP
4935 N 30TH ST
COLORADO SPRINGS, CO 80919
CONTRACT NUMBER:
DR ARNE KALMA

TITLE:
HARDENED INFRARED DETECTORS USING GALLIUM-ARSENIDE/ALUMINUM
GALLIUM ARSENIDE SUPERLATTICE TECHNOLOGY
TOPIC# 3 OFFICE: IDENT#: 38496

THE FEASIBILITY OF USING GaAs/AlGaAs SUPERLATTICE STRUCTURES IS BEING INVESTIGATED TO FABRICATE HIGH PERFORMANCE INFRARED DETECTORS THAT ARE HARD TO BOTH GAMMA FLUX AND TOTAL IONIZING DOSE ENVIRONMENTS. ANALYSIS IS BEING PERFORMED ON THE HARDNESS OF SEVERAL DESIGN CONCEPTS FOR INFRARED DETECTORS BASED ON THESE STRUCTURES AND EXPERIMENTAL VALIDATION IS BEING CONDUCTED OF THE HARDNESS MODEL FOR THE BASELINE STRUCTURE. THE ANALYSIS IS UTILIZING EXISTING MODELS FOR INFRARED DETECTORS PERFORMANCE IN A RADIATION ENVIRONMENT FOR WHICH MOST OF THE INPUT PARAMETERS ARE KNOWN. THE MODEL IS BEING APPLIED BOTH TO THE BASELINE STRUCTURE AND TO ADVANCE HARDENED DESIGNS. IT IS ALSO BEING VERIFIED BY MEASURING THE RESPONSE OF A BASELINE DEVICE TO BOTH A GAMMA-FLUX ENVIRONMENT AND TOTAL DOSE ENVIRONMENT USING AN E-BEAM. THE HARDNESS TO A GAMMA-FLUX ENVIRONMENT CAN BE IMPROVED BY OPERATING THE DEVICE IN A INTRINSIC EVENT DISCRIMINATION MODE. IN THIS STUDY, THE CONDITIONS ARE BEING EXAMINED UNDER WHICH ADVANCED HARDENED SUPERLATTICE/QUANTUM WELL DETECTORS CAN OPERATE IN THIS MODE USING THE MOST SOPHISTICATED MODELS TO DESCRIBE OPERATION. BECAUSE THIS IS A III-V MATERIAL TECHNOLOGY (FOR WHICH THERE IS A LARGE EXISTING COMMERCIAL BASE), IT HOLDS PROMISE OF BEING MORE READILY PRODUCIBLE THAN A II-VI

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MATERIAL TECHNOLOGY SUCH AS HgCdTe. THUS, THIS TECHNOLOGY COULD BE A CANDIDATE TO REPLACE THE TROUBLESOME HgCdTe TECHNOLOGY FOR THE PRODUCTION OF INFRARED DETECTORS.

MISSION RESEARCH CORP
1720 RANDOLPH RD SE
ALBUQUERQUE, NM 87106
CONTRACT NUMBER:
DR KENNETH W STRUVE

TITLE:

HEAVY ORGANIC MOLECULES FOR ION CHANNEL GUIDING OF ELECTRON BEAMS
TOPIC# 1 OFFICE: IDENT#: 38497

ION-CHANNEL GUIDING OF HIGH-CURRENT ELECTRON BEAMS THROUGH ACCELERATORS HAS NOT WORKED AS WELL AS NEEDED. THE BEAMS ALWAYS EXPERIENCE A LARGE EMITTANCE GROWTH (INCREASE IN TRANSVERSE TEMPERATURE) WHICH IS LIKELY CAUSED BY CHANNEL-ION MOTION. THE RESULT IS THAT WITH THE ADVANCED TEST ACCELERATOR (ATA), FOR EXAMPLE, ONLY 15 ns OF LESS OF THE TRANSPORTED BEAM SELECTIONS WHERE THE BEAM IS BEING GUIDED OR CONDITIONED WITH MAGNETIC ELEMENTS. ONE WAY TO INCREASE THE USEFUL PULSE WIDTH IS TO USE A HEAVIER MASS ION SPECIES TO SLOW DOWN THE ION MOTION. IN THIS INVESTIGATION, HEAVY ORGANIC MOLECULES CONSISTING COMBINATION OF BENZENE RINGS ARE BEING USED THAT WOULD HAVE SIMILAR IONIZATION PROPERTIES AS THAT OF CURRENTLY-USED SIMPLE BENZENE OR DIETHYLANILINE. CURRENT RESEARCH CONSISTS OF: A SURVEY OF THE POSSIBLE CANDIDATES; AN EVALUATION AGAINST SPECIFIC CRITERIA BASED ON AVAILABLE INFORMATION; SELECTION OF LIKELY CANDIDATES; AND, DESIGN OF EXPERIMENTS TO MEASURE BOTH IONIZATION AND FRAGMENTATION CROSS SECTIONS. THE RESULTS OF THIS WORK COULD HAVE IMMEDIATE IMPACT ON THE OPERATION OF THE SDIO-FUNDED FEL WORK ON THE ATA, ALLOWING IT TO PRODUCE FULL DESIGN PARAMETER BEAMS FOR WIGGLER EXPERIMENTS. THE WORK MAY ALSO SUBSTANTIALLY REDUCE COSTS OF ACCELERATORS FOR DELPHI APPLICATIONS. IT ALSO DIRECTLY AFFECTS DARAP-FUNDED RESEARCH ON RECIRCULATING INDUCTION ACCELERATORS FOR ARMY AND NAVY APPLICATIONS, SINCE AT LEAST ONE OF THE APPROACHES RELIES ON ION-CHANNEL GUIDING.

MISSION RESEARCH CORP
1720 RANDOLPH RD SE
ALBUQUERQUE, NM 87106
CONTRACT NUMBER:
CHERYL J WHITE

TITLE:

SIDEBAND SUPPRESSION IN HIGH POWER FREE ELECTRON LASERS
TOPIC# 1 OFFICE: IDENT#: 38498

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A SELF-REGENERATIVE FEEDBACK TECHNIQUE IS BEING INVESTIGATED TO SUPPRESS THE FORMATION OF SIDEBANDS THAT LIMIT THE SPECTRAL BRIGHTNESS AND GENERAL PERFORMANCE OF PRESENT HIGH-POWER FREE ELECTRON LASERS (FELs). THIS TECHNIQUE DOES NOT INVOLVE INTRA-CAVITY COMPONENTS THAT SUFFER LOSS DAMAGE DUE TO HIGH POWER OPERATION. A POTENTIAL BREAKTHROUGH IN FEL TECHNOLOGY, ANALYSIS AND SIMULATION ARE BEING PERFORMED TO OPTIMIZE THE OPTICAL DESIGN OF THE SELF-REGENERATIVE SYSTEM. POTENTIAL COMMERCIAL APPLICATIONS EXIST IN INDUSTRIAL MATERIALS PROCESSING AND POSSIBLE SURGICAL AND REMOTE SENSING USES.

MOLTECH CORP
PO BOX 572
SHOREHAM, NY 11786
CONTRACT NUMBER:
DR TERJE A SKOTHEIM
TITLE:
CONDUCTING POLYMER SUPERLATTICE STRUCTURES
TOPIC# 14 OFFICE: IDENT#: 38506

THIS PROJECT PROVIDES THE DESIGN AND TESTING OF A NEW THIN FILM SYSTEM FOR ORGANIC NONLINEAR OPTICS, BASED ON ORGANIC SUPERLATTICES CONSISTING OF ALTERNATING LAYERS OF CONDUCTING POLYMERS AND NON-LINEAR OPTICAL ORGANIC MOLECULES DEPOSITED BY THE LANGMUIR-BLODGETT TECHNIQUE. THE CONDUCTING LAYERS CONSIST OF POLYMERIZED ALKYL SUBSTITUTED PYRROLES WHICH ARE DOPED TO BECOME HIGHLY CONDUCTIVE. INCORPORATED BETWEEN THE POLYPYRROLE LAYERS ARE SURFACE-ACTIVE, NONLINEAR OPTICAL MOLECULES. THESE STRUCTURES ALLOW HIGH LOCAL ELECTRIC FIELDS TO BE GENERATED WITH SMALL APPLIED EXTERNAL VOLTAGES. THIS WILL RESULT IN ENHANCED NONLINEAR OPTICAL RESPONSE OF THE INCORPORATED MOLECULES. THE MOLECULES USED TO FABRICATE THE SUPERLATTICE ARE DESIGNED TO PROVIDE THE DESIRED NONLINEAR OPTICAL RESPONSE, COMBINED WITH ENHANCED PROCESSING CHARACTERISTICS AND CONTROLLABLE MOLECULAR ORGANIZATION. THE RESULTANT NONLINEAR OPTICAL SYSTEMS, WITH ENHANCED RESPONSE TAILORED TO SPECIFIC SPECTRAL REGIMES, WILL MAKE POSSIBLE NEW DEVICES FOR OPTICAL COMMUNICATION AND DATA PROCESSING.

MOLTECH CORP
PO BOX 572
SHOREHAM, NY 11786
CONTRACT NUMBER:
DR PETER E VANIER
TITLE:
PLASMA-ASSISTED CHEMICAL VAPOR DEPOSITION OF DIAMOND FILMS
TOPIC# 14 OFFICE: IDENT#: 38507

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THIS PROJECT DESIGNS A NOVEL PLASMA DEPOSITION SYSTEM FOR THE SYNTHESIS OF CRYSTALLINE DIAMOND FILMS. THE PLASMA ENHANCED CHEMICAL VAPOR DEPOSITION METHOD USED ALLOWS A IMPROVED CONTROL OF THE DEPOSITION CONDITIONS. THE CONSTRUCTION ALLOWS TAILORING OF THE REACTIONN RATES OF THE VARIOUS SPECIES BY CONTROLLING THE ENERGY DISTRIBUTION OF THE ELECTRONS (AND THE IONS) OF THE PLASMA. THE HIGH DEGREE OF CONTROL OF THE PLASMA PARAMETERS AFFORDED BY THE SYSTEM IS USED TO STUDY THE REACTION KINETICS OF SEVERAL CARBON PRECURSOR SPECIES. EMPHASIS IS PLACED ON DEVELOPING THE CONDITIONS FOR EFFICIENT NUCLEATION AND GROWTH OF LARGE CRYSTALLINE DIAMOND FILMS FOR ELECTRONIC APPLICATIONS. THE SUCCESSFUL DEVELOPMENT OF ELECTRONIC-GRADE DIAMOND FILMS WILL HAVE IMPORTANT IMPLICATIONS FOR DEVELOPING ELECTRONIC DEVICES FOR HIGH TEMPERATURE AND HOSTILE ENVIRONMENTS, SUCH AS RADIATION RESISTANT DEVICES FOR OPERATION IN SPACE.

NETROLOGIC INC
4241 JUTLAND DR
SAN DIEGO, CA 92117
CONTRACT NUMBER:
DAN GREENWOOD

TITLE:

NEURAL NETWORK FOR SOLVING OPTIMIZATION PROBLEMS

TOPIC# 10 OFFICE: IDENT#: 38514

IN THIS INVESTIGATION, AN ADAPTIVE PROCEDURE CAPABLE OF DESIGNING AND OPTIMIZING NEURAL NETWORKS FOR SOLVING PRESPECIFIED PROBLEMS IS BEING DEVELOPED. ADAPTIVE PROCEDURES, ESPECIALLY GENETIC ALGORITHMS, ARE BEING APPLIED TO DESIGN THE NEURAL TRANSFER FUNCTION OF RECURRENTLY CONNECTED NETWORKS. THIS INVOLVES FINDING A SUITABLE REPRESENTATION FOR THE SPACE OF NEURAL TRANSFER FUNCTIONS IN WHICH THE GENETIC ALGORITHM MAY PERFORM ITS GUIDED SEARCH, FOLLOWED BY SIMULATED GENETIC ADAPTATION OF THE NETWORKS IN THE GIVEN TASK ENVIRONMENT. THE RESULT IS EXPECTED TO BE MORE COMPACT AND POWERFUL NETWORKS SPECIFICALLY TAILORED TO A GIVEN TASK DOMAIN. THE PROCEDURE IS BEING USED TO AUTOMATICALLY DESIGN NEURAL NETWORKS TO SOLVE OPTIMIZATION PROBLEMS IN PATH PLANNING, IMAGE ENCODING/DECODING AND PATTERN RECOGNITION. FOR THOSE INDUSTRIES EMPLOYING NEURAL NETWORK

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SOLUTIONS THE ABILITY TO ADAPT A NEURAL NETWORK TO A GIVEN PROBLEM
DOMAIN WOULD RESULT IN A MORE EFFECTIVE, COMPACT, AND LESS COSTLY
IMPLEMENTATION.

NORTH EAST SEMICONDUCTOR INC

134 LEXINGTON DR

ITHACA, NY 14850

CONTRACT NUMBER:

COLIN E C WOOD

TITLE:

HIGH THROUGHPUT MOLECULAR BEAM EPITAXY MATERIALS FOR MODULATION
DOPED FIELD-EFFECT TRANSISTORS

TOPIC# 14

OFFICE:

IDENT#: 38523

MOLECULAR BEAM EPITAXY (MBE) IS THE CURRENTLY PREFERRED TECHNIQUE FOR
MANUFACTURING SPECIALIZED COMPOUND SEMICONDUCTOR DEVICE MATERIALS FOR
LASERS, SUCH AS GaAs AND ITS ALLOYS WITH AlAs AND InAs. THIS IS
BECAUSE OF THE MATERIALS' SUPERIOR REPRODUCIBILITY, UNIFORMITY, AND
NON-HAZARDOUS NATURE. HOWEVER, CONVENTIONAL MBE GROWTH RATES ARE
ABOUT 1 MICRON PER HOUR, WHICH LIMITS THROUGHPUT. COMBINED WITH THE
HIGH COST OF EQUIPMENT REQUIRED, THIS MAKES CONVENTIONAL MBE WAFERS
MORE EXPENSIVE THAN ORGANIC METALLIC VAPOR PHASE EPITAXY (OMVPE)
EQUIVALENTS. THIS PROJECT EVALUATES THE FEASIBILITY OF MBE GROWTH
OF PLANAR DOPED GaAs/AlGaAs MODFET LAYERS AT RATES UP TO 10 MICRONS
PER HOUR, BY STUDYING THE ELECTRICAL PROPERTIES OF EPITAXIAL
STRUCTURES AS A FUNCTION OF INCREASING GROWTH RATE. THIS
INVESTIGATION WILL ENABLE THE COST OF MBE GaAs WAFERS TO BE REDUCED
TO A FRACTION OF THE CURRENT COST. THIS WOULD PERMIT MORE WIDESPREAD
USE OF GaAs COMPONENTS IN MILITARY AND CIVILIAN SYSTEMS SUCH AS
PHASED ARRAY RADAR AND HIGH FREQUENCY COMMUNICATIONS.

NORTH EAST SEMICONDUCTOR INC

134 LEXINGTON DR

ITHACA, NY 14850

CONTRACT NUMBER:

A A KARPINSKI

TITLE:

LOW COST TWO DIMENSIONAL LASER DIODE ARRAY PRODUCTION TECHNIQUES

TOPIC# 3

OFFICE:

IDENT#: 38524

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A LOW COST METHOD OF PRODUCING TWO DIMENSIONAL (2D) LASER DIODE ARRAYS IS BEING INVESTIGATED. USING AN ASSEMBLY PROCESS, GREAT SIMPLIFICATIONS ARE EXPECTED IN DIODE ARRAY PACKAGING. HIGH EFFICIENCY LASER WAFERS ARE BEING PROCESSED INTO BROAD AREA LASERS IN BAR FORM AND MOUNTED. A PROTOTYPE 2D LASER ARRAY OPERATING AT 808 nm IS BEING ASSEMBLED AND TESTED IN THIS PROGRAM. THE GOAL IS TO ACHIEVE BETTER THAN 40% CONVERSION EFFICIENCY AT A POWER DENSITY OF 3 KW/cm². THE BENEFITS OF A SUCCESSFUL PROGRAM IS THE REALIZATION OF LOW COST, RELIABLE 2D DIODE LASER ARRAYS FOR PUMPING SOLID STATE LASERS. THE SOLID STATE LASER WOULD FIND USE IN MILITARY SYSTEMS FOR COMMUNICATIONS AND REMOTE SENSING. COMMERCIAL APPLICATIONS INCLUDE METAL MACHINING WITH HIGH POWER COMPACT LASERS AND SATELLITE COMMUNICATIONS.

NORTH STAR RESEARCH CORP

555 ZUNI SE - STE 345

ALBUQUERQUE, NM 87108

CONTRACT NUMBER:

RICHARD J ADLER

TITLE:

HIGH VOLTAGE HIGH POWER NESTED HIGH VOLTAGE GENERATORS

TOPIC# 1

OFFICE:

IDENT#: 38520

COMPACT, LOW MASS, HIGH ENERGY DENSITY PARTICLE ACCELERATOR DEVELOPMENT IS EXTREMELY DESIRABLE FOR SPACE BASED DIRECTED ENERGY APPLICATIONS. NESTED HIGH VOLTAGE MODULES, EACH CHARGED TO A HIGH VOLTAGE, ARE CAPABLE OF PROVIDING A DC ELECTROSTATIC FIELD GRADIENT WHICH IN THE CORRECT TOPOLOGICAL ARRANGEMENT WILL GENERATE AN ACCELERATING POTENTIAL APPROACHING 0.5 MV PER CENTIMETER OF DIAMETER. ULTIMATE VOLTAGES OF >20 MeV IN AN EFFICIENT CONFIGURATION MAY BE POSSIBLE. BOTH HIGH POWER PULSED, AND DC OPERATION ARE POSSIBLE IN THE SAME DEVICE. IN ORDER TO DEMONSTRATE THE FUNDAMENTAL PRINCIPLES OF OPERATION, A SEVEN MODULE, 350 kV, 5mA, DC ACCELERATOR WILL BE CONSTRUCTED USING RESONANT CHARGING OF THE NESTED CELLS. A FIBER OPTICALLY TRIGGERED PLASMA FLASHBOARD ELECTRON SOURCE LOCATED ON THE INNER MOST MODULE CAN CONCEPTUALLY PRODUCE AN INTENSE 0.2 Ka BEAM SOURCE. A WORKING PROTOTYPE DEMONSTRATING THE MERITS OF THE CONCEPT AND ITS SCALING WILL BE THE PHASE I TECHNICAL GOAL. WHEN

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SUCCESSFULLY DEVELOPED, A NEW CLASS OF COMPACT, HIGH VOLTAGE ELECTROSTATIC ACCELERATORS WILL EXIST FOR SPACE BASED FREE ELECTRON LASERS AND OTHER DIRECTED ENERGY WEAPONS SYSTEMS. COMMERCIAL APPLICATIONS INCLUDE: RADIATION PROCESSING OF FOOD, MEDICAL PRODUCTS AND PLASTICS, SEMICONDUCTOR MANUFACTURING, MEDICAL ISOTOPE PRODUCTION, AND MATERIAL SURFACE CHARACTERIZATION.

OPTI-COMP CORP
PO BOX 10779
ZEPHYR COVE, NV 89448
CONTRACT NUMBER:
PETER S GUILFOYLE
TITLE:
DIGITAL OPTICAL COMPUTER GLOBAL INTERCONNECT ALGORITHM STUDY
TOPIC# 11 OFFICE: IDENT#: 38540

THE USE OF GLOBAL INTERCONNECTS IN DIGITAL OPTICAL COMPUTERS AT THE GATE LEVEL SHOWS THE POTENTIAL TO ACHIEVE GATE INTERCONNECT BANDWIDTH PRODUCTS OF UP TO 10^{16} WITH POWER CONSUMPTION ON THE ORDER OF 100W. IN THIS STUDY, METHODS OF HARNESSING THESE INTERCONNECTS FOR WIDE-WORD DIGITAL COMPUTATION PRIMITIVES SUCH AS EXCLUSIVE OR, ADD, AND MULTIPLY ARE INVESTIGATED. EFFICIENT IMPLEMENTATION OF THESE PRIMITIVES COULD ULTIMATELY MAKE DIGITAL OPTICAL COMPUTING COMPETITIVE WITH CONVENTIONAL OR SUPERCONDUCTOR IMPLEMENTATIONS OF COMPUTER HARDWARE. DIGITAL OPTICAL COMPUTERS OFFER A TECHNOLOGY THAT CAN ACHIEVE EXTREMELY HIGH PROCESSING THROUGHPUT IN A DENSE, LOW POWER PACKAGE. DEFENSE APPLICATIONS INCLUDE SIGNAL PROCESSORS FOR WEAPONS, SPACE BASED STRATEGIC SURVEILLANCE, AND ACOUSTIC SIGNAL PROCESSING. COMMERCIAL USES AS SEISMIC SIGNAL PROCESSING, AERODYNAMIC MODELING SIMULATION, AND IMAGE PROCESSING.

OPTRON SYSTEMS INC
3 PRESTON CT
BEDFORD, MA 01730
CONTRACT NUMBER:
IRA FARBER
TITLE:
OPTICAL WAVEFRONT COMPUTER FOR STABILIZING LARGE SPACE STRUCTURES
TOPIC# 11 OFFICE: IDENT#: 38544

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THIS STUDY INVESTIGATES AN UNCONVENTIONAL OPTICAL SUBSYSTEMS, THE OPTICAL WAVEFRONT COMPUTER (OWC). THE OWC, WHEN USED IN CONJUNCTION WITH AN IMPRECISELY FIGURED LARGE-APERTURE OPTICAL ELEMENT SUCH AS A TELESCOPE MIRROR, CAN MEASURE AND COMPENSATE THE OPTICAL ABERRATIONS INTRODUCED BY UTILIZING A HOLOGRAPHIC OPTICAL PROCESSOR TO PROVIDE PHASE CORRECTION. THIS TECHNIQUE ELIMINATES THE NEED FOR LARGE, COMPLEX DIGITAL COMPUTERS AS INCORPORATED IN CONVENTIONAL EARTH-BASED ADAPTIVE OPTICAL SYSTEMS. THE OWS IS A COMPACT LIGHT-WEIGHT SYSTEM THAT OPERATES WITH PASSIVE INCOHERENT OR COHERENT ILLUMINATION AND IS SCALABLE TO TENS OF THOUSANDS OF INDEPENDENT CORRECTION SUB-APERTURES. THE OWC EMPLOYS A MOSTLY OPTICAL PROCESSOR TO COMPUTE PHASE. UNLIKE CONVENTIONAL SYSTEMS, IT CAN DRIVE EITHER OPTICALLY OR ELECTRONICALLY-ADDRESSED OR PHASE-ONLY CORRECTION ELEMENTS. ITS COMPLEXITY DOES NOT SCALE WITH THE NUMBER OF RESOLUTION CHANNELS. IT REQUIRES MINIMAL OPERATING POWER, AND ITS COST IS EXPECTED TO BE LOWER. COMMERCIAL APPLICATIONS INCLUDE ASTRONOMICAL INSTRUMENTATION DEVELOPMENT, OPTICAL TESTING, HORIZONTAL-PATH LASER COMMUNICATIONS, AND CORRECTION OF ABERRATIONS IN OPTICAL INSTRUMENTS.

ORTEL CORP
2015 W CHESTNUT ST
ALHAMBRA, CA 91803

CONTRACT NUMBER:

DR JEFFREY UNGAR

TITLE:

SEMI-INSULATING INDIUM-ALUMINUM-ARSENIDE GROWTH BY METALLORGANIC
CHEMICAL VAPOR DEPOSITION

TOPIC# 14 OFFICE:

IDENT#: 38551

THIS PROJECT PROVIDES THE DEVELOPMENT OF A SEMI-INSULATING InAlAs LATTICE, MATCHED TO InP USING OXYGEN AS A DOPANT. THIS APPROACH PROVIDES CURRENT BLOCKING LAYERS FOR 1.3 AND 1.5 MICROMETER WAVELENGTH LASER DIODES. THE POTENTIAL ADVANTAGES OF THIS TECHNIQUE, OVER CONVENTIONAL CURRENT BLOCKING STRUCTURES, INCLUDE HIGHER FABRICATION YIELDS AND SUPERIOR HIGH TEMPERATURE OPERATION. THE SUCCESSFUL DEVELOPMENT OF THIS TECHNIQUE WOULD PROVIDE LOWER COST LASER SOURCES FOR FIBER OPTIC COMMUNICATION SYSTEMS AND PERMIT HIGH TEMPERATURE LASER OPERATION FOR FIBER OPTIC SYSTEM APPLICATIONS

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SUCH AS AVIONICS.

OXLEY RESEARCH INC
71 EDGEHILL RD
NEW HAVEN, CT 06511
CONTRACT NUMBER:
DR JAMES OXLEY

TITLE:

HIGH RATE ELECTROCHEMICAL CAPACITORS

TOPIC# 5

OFFICE:

IDENT#: 38553

CAPACITIVE ENERGY STORAGE HAS LONG BEEN RELIED UPON FOR FULFILLING THE NEED FOR SHORT BURSTS OF ELECTRICAL POWER. SUCH NEEDS HAVE USUALLY BEEN MET WITH EITHER ELECTROLYTIC OR ELECTROSTATIC CAPACITORS. WHERE VERY HIGH ENERGY DENSITIES ARE REQUIRED, NEITHER OF THESE TECHNOLOGIES IS SUITABLE AND INSTEAD RECHARGEABLE PILE-TYPE BATTERIES HAVE BEEN EMPLOYED. ELECTROCHEMICAL CAPACITORS OFFER THE CAPABILITY OF BRIDGING THE GAP BETWEEN CONVENTIONAL CAPACITORS AND RECHARGEABLE BATTERIES, AND FALL INTO TWO CATEGORIES, NAMELY DOUBLE LAYER CAPACITORS WHICH RELY SOLELY ON INTERFACIAL CHARGE SEPARATION, ACROSS THE ELECTRICAL DOUBLE LAYER, AND PSEUDOCAPACITORS, WHICH HAVE ENHANCED CHARGE STORAGE DERIVED FROM FARADAIC CHARGE TRANSFER REACTIONS, IN PARALLEL WITH THE DOUBLE LAYER. IN THIS PROGRAM, THE FEASIBILITY OF HIGH SURFACE AREAS, AND THEREBY LOW (ESR), BIPOLAR ELECTROCHEMICAL CAPACITORS, HAVING SUPERIOR ENERGY AND POWER DENSITIES IS BEING DEMONSTRATED. THE TECHNICAL APPROACH INCLUDES DOUBLE LAYER AND PSEUDOCAPACITIVE ELECTRODE MATERIALS. THE OBJECTIVE IS FABRICATION OF SMALL RESEARCH PROTOTYPE CELLS DEMONSTRATING SUPERIOR PULSE-DISCHARGE CAPABILITY. SUCCESSFUL DEVELOPMENT OF HIGH POWER/HIGH ENERGY DENSITY ELECTROCHEMICAL CAPACITORS WOULD PROVIDE AN ATTRACTIVE ALTERNATIVE TO THE USE OF CONVENTIONAL ENERGY STORAGE CAPACITORS. SPECIFIC AREAS MIGHT INCLUDE: APPLICATIONS WHERE MULTIPLE HIGH ENERGY PULSES ARE DESIRED FOLLOWING A SINGLE CHARGE; APPLICATIONS DEMANDING SUPERIOR CHARGE RETENTION; AND, HYBRID SYSTEMS TOGETHER WITH RELATIVELY LOW POWER DENSITY, BUT HIGH ENERGY DENSITY, RECHARGEABLE BATTERIES.

PACIFIC APPLIED RESEARCH
6 CRESTWIND DR
RANCHO PALOS VERD, CA 90274
CONTRACT NUMBER:
WALTER R WARREN JR

TITLE:

TWO-STEP COMBUSTOR FOR HYDROGEN FLUORIDE CHEMICAL LASERS

TOPIC# 1

OFFICE:

IDENT#: 38554

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OPERATION OF A CONTINUOUS WAVE (CW) HYDROGEN FLUORIDE (HF) CHEMICAL LASER WITH A TWO-STEP COMBUSTOR (He DILUENT ADDED AFTER THE NF₃/D₂ REACTION) INSTEAD OF A CONVENTIONAL, ONE-STEP COMBUSTOR (He PRE-MIXED WITH REACTANTS) IS EXPECTED TO INCREASE THE AMOUNT OF TOTAL SYSTEM CHEMICAL ENERGY (AND REDUCE COMBUSTION-GENERATED DEACTIVATORS) DELIVERED TO THE LASING PROCESS BY THE ORDER TO 50%. LASER OPERATION IS ANTICIPATED TO BE AN ARBITRARY DEGREE ON THE CHAIN REACTION, WHICH FURTHER UTILIZES THE STORED CHEMICAL ENERGY IN THE LASING PROCESS AND HAS SEVERAL CHARACTERISTICS ASSOCIATED WITH HIGH VIBRATIONAL LEVEL PUMPING THAT ENHANCES HF OVERTONE, DELTA V EQUALS TWO LASER OPERATION. IN THIS INVESTIGATION, THE IMPROVEMENT IN SPECIFIC POWER PERFORMANCE IS BEING DETERMINED OF THE HF FUNDAMENTAL TRANSITION, DELTA V EQUALS ONE LASER MADE POSSIBLE BY THE TWO-STEP COMBUSTIONN PROCESS WHEN PERATING FULLY ON THE COLD REACTION THOUGH LARGELY ON THE CHAIN REACTION. PERFORMANCE OF THE HF DELTA V EQUALS TWO LASER IS ALSO BEING DETERMINED OVER ESSENTIALLY THE SAME RANGES OF TEST CONDITIONS. DEVELOPMENT OF HIGH POWER FUNDAMENTAL TRANSITION AND OVERTONE TRANSITION (SHORT WAVELENGTH) HYDROGEN FLUORIDE CHEMICAL LASERS FOR DOD/SDIO APPLICATIONS.

PDA ENGINEERING
2975 REDHILL AVE
COSTA MESA, CA 92626
CONTRACT NUMBER:
DR RONALD E ALLRED
TITLE:
POLYSILYLENE DERIVED OPTICAL WAVEGUIDES FOR OPTICAL COMPUTING
TOPIC# 11 OFFICE: IDENT#: 38564

THIS EFFORT DETERMINES THE FEASIBILITY OF USING PHOTOPATTERNABLE POLYSILYLENES FOR THE DRY PHOTOFABRICATION OF OPTICAL WAVEGUIDES AND OPTICAL PROCESSING ELEMENTS FOR DIGITAL OPTICAL COMPUTING SYSTEMS. THE STUDY EXPLORES THE LONG PATHLENGTH ABSORPTION OF THESE MATERIALS OVER THE RANGE FROM 350 TO 860 nm AS A FUNCTION OF POLYMER MOLECULAR STRUCTURE AND PATTERN FORMATION PROCESSING. OXIDATIVE CONVERSION OF POLYSILYLENE SURFACES TO PROVIDE CLADDING FOR THE WAVEGUIDES IS BEING CHARACTERIZED IN TERMS OF CONVERSION RATE AND SURFACE STRUCTURE AS FUNCTIONS OF POLYMER STRUCTURE AND PROCESSING PARAMETERS. CHANGES

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IN THE ABSORPTION COEFFICIENT AND REFRACTIVE INDEX WHICH OCCUR DURING PHOTOPROCESSING ARE ALSO BEING EXAMINED. ADDITIONALLY, THE REFRACTIVE INDICES OF BOTH THE BASE POLYMER CONVERSION COATINGS AND THE UTILITY OF THESE MATERIALS FOR OPTICAL WAVEGUIDES ARE BEING DETERMINED. THE PHOTOPATTERNABILITY OF POLYSILYLENES COULD FORM THE BASIS FOR NEW MANUFACTURING TECHNIQUES FOR OPTICAL COATINGS IN APPLICATIONS INCLUDING DIGITAL OPTICAL COMPUTING COMPONENTS.

PHOTONIC SYSTEMS INC
1900 S HARBOR CITY BLVD
MELBOURNE, FL 32901

CONTRACT NUMBER:

DENNIS R PAPE

TITLE:

OPTICAL LIGHT DETECTION AND RANGING TOMOGRAPHIC IMAGE
RECONSTRUCTION PROCESSOR

TOPIC# 11 OFFICE: IDENT#: 38578

LIGHT DETECTION AND RANGING (LIDAR) TECHNOLOGY PROVIDES A POWERFUL MEANS OF IMAGING SPACEBORNE OBJECTS USING INVERSE SYNTHETIC APERTURE RADAR (ISAR) RANGE RESOLVE TOMOGRAPHIC RECONSTRUCTION PROCESSING TECHNIQUES. THESE ISAR TECHNIQUES, HOWEVER, BECOME INEFFECTIVE WHEN THE OBJECT IS ONLY VIEWED FOR A SMALL FRACTION OF A ROTATIONAL. THE FORMIDABLE SIGNAL PROCESSING REQUIREMENTS INHERENT IN AN ISAR IMAGING APPLICATION REQUIRE INNOVATIVE TECHNIQUES TO MINIMIZE THE SIZE, POWER, AND WEIGHT OF THE SIGNAL PROCESSOR, PARTICULARLY FOR SPACEBORNE APPLICATIONS. A NEW ALGORITHMIC APPROACH TO THE LIMITED VIEWING ANGLE PROBLEM USES A SIGNAL PROCESSING ANALOG TO TIME-OF-FLIGHT POSITION EMISSION TOMOGRAPHY (TOFPET) TO RECONSTRUCT THE OPTICAL RANGE-DOPPLER SCATTERING FUNCTION OF THE OBJECT. IN THIS EFFORT, AN OPTICAL SIGNAL PROCESSOR IS BEING DEVELOPED USING ACOUSTO-OPTIC TECHNOLOGY THAT RECONSTRUCTS LIDAR TOMOGRAPHIC IMAGES. THE VERSATILITY AND LOWER SIZE, POWER, AND WEIGHT OF THIS PROCESSOR COULD IMPACT MANY IMAGING RADAR AND LIDAR SYSTEMS THROUGHOUT THE MILITARY SERVICES. SIGNAL PROCESSING INTENSIVE FUNCTIONNS IN INDUSTRY, SUCH AS SEISMIC PROCESSING, COULD ALSO BENEFIT FROM THIS CAPABILITY.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505

CONTRACT NUMBER:

DR TOMASZ JANNSON

TITLE:

HOLO-CRYSTAL DYNAMIC SCANNER FOR SPACE COMMUNICATION

TOPIC# 3 OFFICE: IDENT#: 38587

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AN APPROACH TO DYNAMIC OPTICAL SCANNING IS BEING INVESTIGATED BASED ON NON-LINEAR MATERIALS AND HOLOGRAPHIC TECHNIQUES. THE NONLINEAR HOLO-CRYSTAL SCANNER (HCS) CONCEPT OFFERS GOOD PROMISE OF BEING THE PRECURSOR TO THE NEXT GENERATION OF OPTICAL SCANNING SYSTEMS. ITS PRIMARY INNOVATION IS ELECTRO-OPTIC CONTROL OF THE OUTPUT BEAM DIRECTION IN ALL DIMENSIONS. THE SCANNER CONFIGURATION INVOLVES THE INTEGRATION OF HIGH EFFICIENCY BRAGG HOLOGRAMS WITH NONLINEAR OPTICALLY ACTIVE MODULATORS BASED ON LIQUID CRYSTALS OR ELECTRO-OPTIC POLYMERS. THE HCS BEING INVESTIGATED IS THE FIRST OF ITS KIND TO UTILIZE THE PROPERTIES OF NON-LINEAR ELECTRO-OPTIC MATERIALS WITH WAVEGUIDE-IMPLANTED HOLOGRAMS TO ACHIEVE ELECTRICALLY CONTROLLED BEAM SCANNING. FOR MANY TACTICAL AND STRATEGIC DEFENSE APPLICATIONS, THE NECESSITY OF FAST NON-MECHANICAL SCANNERS IS ALMOST SELF-EVIDENT. SCANNERS CAN BE USED TO COMMUNICATE BETWEEN SATELLITES, RADARS AND AIRCRAFTS. IN ADDITION TO THE TACTICAL AND STRATEGIC APPLICABILITY OF THE HCS SYSTEM AS A WHOLE, ITS BASIC SUB-SYSTEMS COULD FIND INDEPENDENT MILITARY AND COMMERCIAL MARKETS.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505

CONTRACT NUMBER:

DR FREDDIE LIN

TITLE:

HOLOGRAPHIC SPATIAL LIGHT MODULATOR-BASED OPTICAL COMPUTING

TOPIC# 11

OFFICE:

IDENT#: 38590

A METHOD OF INTEGRATING CONVENTIONAL SPATIAL LIGHT MODULAR (SLM) TECHNOLOGY WITH ADVANCED HOLOGRAPHIC TECHNIQUES IS BEING INVESTIGATED FOR OPTICAL COMPUTING USE. THIS NEW TECHNOLOGY, HOLOGRAPHIC SPATIAL LIGHT MODULATION (HSLM), SHOULD PERFORM OPERATIONS SUCH AS LOGIC GATE FUNCTIONS, DATA FAN-IN/FAN-OUT, AND WAVEFRONT RESHAPING THAT CANNOT BE PERFORMED WITH CONVENTIONAL BEAM MODULATION. CONVENTIONAL SLMs HAVE STRINGENT REQUIREMENTS SUCH AS IDEAL NONLINEAR CHARACTERISTICS AND PRE-BIAS INTENSITY LEVELS WHICH MAY BE ELIMINATED OR REDUCED WITH HSLMs. ADDITIONALLY, THE MULTIPLEXING AND STORAGE CAPABILITIES OF HSLMs ALLOW MANY FLEXIBLE AND POWERFUL OPERATIONS TO BE ACHIEVED IN A COMPACT AND RUGGED SYSTEM PACKAGE. THE INTEGRATION OF SPATIAL

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LIGHT MODULATION TECHNOLOGY AND HOLOGRAPHIC TECHNIQUES COULD BE USED FOR OPTICAL COMPUTING SYSTEMS, RECONFIGURABLE OPTICAL INTERCONNECTS, NEUROCOMPUTING, PATTERN RECOGNITION, AND IMAGE PROCESSING.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505
CONTRACT NUMBER:
DR FREDDIE LIN
TITLE:
MONOLITHIC OPTICAL WAVEGUIDE CROSSBARS FOR LARGE SCALE DATA SWITCHING
TOPIC# 11 OFFICE: IDENT#: 38592

IN THIS STUDY, A COMPACT AND RUGGED OPTICAL WAVEGUIDE CROSSBAR SWITCH, USING SURFACE RELIEF WAVEGUIDE MATERIALS, IS BEING INVESTIGATED. THE SUCCESSFUL DEVELOPMENT OF WAVEGUIDE CROSSBAR SYSTEMS ALLOWS LARGE-SCALE SWITCHING NETWORKS (WITH $N > 100$) TO BE FABRICATED. PROPERTIES OF THE CROSSBAR SWITCH TO BE DEVELOPED INCLUDE: ELIMINATION OF ONE-TO-MANY BEAMSPLITTERS (FAN-OUT) AND MANY-TO-ONE BEAM COMBINERS (FAN-INS); CONTROLLABLE SWITCHING EFFICIENCY; SIMPLE FABRICATION EFFICIENCY; AND HIGH LIGHT EFFICIENCY AND LOW CROSSTALK. ADDITIONALLY, THIS WAVEGUIDE CROSSBAR TECHNOLOGY IS BOTH ELECTRONICALLY AND OPTICALLY-ADDRESSABLE. IN THIS PROJECT, A SMALL-SCALE (2X2) OPTICAL WAVEGUIDE CROSSBAR WITH CONTROLLABLE SWITCHING EFFICIENCY IS BEING EVALUATED FOR DEVICE PERFORMANCE, INCLUDING CROSSTALK, BANDWIDTH, LIGHT EFFICIENCY, AND INSERTION LOSSES. THE MONOLITHIC OPTICAL WAVEGUIDE CROSSBAR SWITCH HAS APPLICATIONS IN RECONFIGURABLE INTERCONNECTIONS NETWORKS, LOCAL AREA NETWORKS, LARGE-SCALE SWITCHING NETWORKS, AND NEURAL NETWORKS.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505
CONTRACT NUMBER:
DR RAY T CHEN
TITLE:
POLYMER GELATIN MICROSTRUCTURE WAVEGUIDES IN CONJUNCTION WITH HOLOGRAPHIC OPTICAL ELEMENTS
TOPIC# 14 OFFICE: IDENT#: 38594

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IN THIS PROGRAM, A NEW POLYMER MICROSTRUCTURE GRADED-INDEX (GRIN) IS BEING INVESTIGATED FOR OPTOELECTRONIC APPLICATIONS ON THE DEVICE AND SYSTEM LEVEL. THE GRIN HAS BEEN PROVED TO FORM GUIDING LAYERS ON ANY SMOOTH SURFACE, INCLUDING CONDUCTORS, SEMICONDUCTORS, AND INSULATORS, DESPITE ITS LOW REFRACTIVE INDEX (APPROXIMATELY 1.5). THE POLYMER FILM SIZE FORMED IS AT LEAST TWO ORDERS OF MAGNITUDE LARGE THAN THE STATE OF THE ART FORMATION SYSTEMS SUCH AS MOLYBDENUM OXIDE CHEMICAL VAPOR DEPOSITION (MOCVD) AND MOLECULAR BEAM EPITAXY (MBE). THE FABRICATION PROCESS ASSOCIATED WITH THE POLYMER MICROSTRUCTURE IS CLAIMED TO BE SIMPLE, AND MUCH LESS COST THAN EITHER MOCVD OR MBE. THE PROCESSED THIN FILM OF THE POLY MICROSTRUCTURE ALSO PROVIDES GRADED INDEX DISTRIBUTION. THE WAVEGUIDE QUALITY IS EXCELLENT (LOSS LESS THAN 1dB PER CM) ON LiNbO₃, GaAs, GLASS, AND ALUMINUM SUBSTRATES. LOCALLY SENSITIZING THE POLYMER WAVEGUIDE WITH AMMONIA DICHROMATE WILL ALLOW INTEGRATED SINGLE AND MULTIPLE HOLOGRAMS IN THE SELECTED AREA, PROVIDING NUMEROUS APPLICATIONS. WHEN SUCCESSFUL, THIS PROGRAM CAN RESULT IN A RELIABLE AND COST EFFECTIVE OPTOELECTRONIC SYSTEM COVERING THE VISIBLE AND INFRARED REGIONS, WITH NUMEROUS APPLICATIONS IN MILITARY ELECTRONIC SYSTEMS. COMMERCIAL APPLICATIONS OF THIS STRUCTURE INCLUDE VLSI OPTICAL INTERCONNECTS, SIGNAL PROCESSING AND COMPUTING DEVICES.

PHYSICON INC
3325 TRIANA BLVD - STE A
HUNTSVILLE, AL 35805
CONTRACT NUMBER:
DAVID O'HARA
TITLE:
HIGH FLUENCE HIGH REFLECTIVITY X-RAY LASER MIRRORS
TOPIC# 1 OFFICE: IDENT#: 38604

IN THIS INVESTIGATION, X-RAY MIRRORS ARE BEING DESIGNED FOR USE IN LABORATORY X-RAY LASER CAVITIES AND OTHER X-RAY LASER OPTICS USING BOTH GLANCING INCIDENCE AND MULTILAYER MIRRORS. THESE MIRRORS ARE BEING OPTIMIZED FOR BOTH SURVIVABILITY IN THE X-RAY ENVIRONMENT AND HIGH REFLECTIVITY. IF MIRRORS OF HIGH FLUENCE AND HIGH REFLECTIVITY COULD BE PRODUCED, THE CURRENT PLASMA X-RAY LASERS AND PROPOSED FREE ELECTRON X-RAY LASERS COULD BE MADE MUCH MORE EFFICIENT BY MULTIPASS

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AMPLIFICATION. THE BEAM DIVERGENCE OF THESE SOURCES COULD ALSO BE REDUCED WITH SUITABLE CAVITY MIRRORS. METHODS TO FABRICATE LASER MIRRORS ARE BEING INVESTIGATED ALONG WITH LIMITATIONS ON MIRROR PERFORMANCE DUE TO MATERIAL AND FABRICATION LIMITATIONS. AN EXPERIMENTAL PLAN TO MAKE AND VALIDATE THE RESULTS OF THIS STUDY WILL ALSO BE ACCOMPLISHED. UPON SUCCESSFUL COMPLETION OF THIS PROGRAM, A NEW CLASS OF X-RAY MIRRORS WOULD EXIST WHICH WOULD NOT ONLY GIVE HIGH REFLECTIVITY, BUT WOULD WITHSTAND HIGH FLUENCES OF SOFT X-RAYS AS WELL. THESE NEW MIRRORS WOULD HAVE APPLICATIONS IN X-RAY LASER FUSION STUDIES, UNDERGROUND NUCLEAR TESTS, NUCLEAR SIMULATORS, X-RAY LITHOGRAPHY, AND OTHER HIGH POWER-DENSITY X-RAY APPLICATIONS. X-RAY LASER WHICH USE THESE MIRRORS IN LASER CAVITIES WOULD HAVE ENHANCED EFFICIENCY, LOWERED BEAM DIVERGENCE, AND INCREASED UTILITY FOR INDUSTRIAL APPLICATIONS.

PRISMOID OPTICAL
RTE 2 - BOX 287
MAPLE LAKE, MN 55358
CONTRACT NUMBER:
RICHARD VIZENOR
TITLE:
LARGE MIRROR FABRICATION WITH HIGH OPTICAL QUALITY
TOPIC# 1 OFFICE: IDENT#: 38612

A PROCESS IS BEING INVESTIGATED IN THIS STUDY TO MANUFACTURE LARGE MIRRORS (40-80 INCH DIAMETER) OF HIGH OPTICAL QUALITY. A UNIQUE ASSEMBLY METHOD INVOLVING THREE BASIC COMPONENTS IS BEING USED. IF SUCCESSFUL, THESE MIRRORS WOULD BE SUPERIOR TO THOSE MANUFACTURED BY CONVENTIONAL METHODS AND MATERIALS BECAUSE OF THEIR: CONSIDERABLE LOWER COST; LIGHTER WEIGHT TO DIAMETER RATIO; THERMAL STABILITY IN HOLDING FIGURE OVER HIGH TEMPERATURE EXTREMES; AND CAPACITY OF HIGHER "G" SHOCK. WHEN SUCCESSFULLY DEVELOPED, A POTENTIAL COMMERCIAL APPLICATION EXISTS IN REAR PROJECTED TV SYSTEMS THAT USE A COMBINATION OF IMAGE-FORMING OPTICS AND FLAT OR CURVED MIRROR. MUCH OF THE COST FOR A QUALITY UNIT GOES INTO THESE COMPONENTS. THIS MIRROR PRINCIPLE COULD EXPAND SCREEN SIZE INCREASE IMAGE QUALITY AND LOWER COST.

QSOURCE INC
151 DEERCLIFF RD
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CONTRACT NUMBER:
PETER P CHENAUSKY
TITLE:
LONG PULSEWIDTH LOW DUTY CYCLE CARBON DIOXIDE TRANSMITTER
TOPIC# 3 OFFICE: IDENT#: 38618

SUBMITTED BY

THIS STUDY INVESTIGATES A CONCEPT FOR IMPROVING THE AVERAGE POWER OF RADAR QUALITY CO2 TRANSMITTERS. DEFENSE APPLICATIONS INCLUDE LASER RADARS AND REMOTE SENSING. COMMERCIAL USES ARE INDUSTRIAL PROCESSES SUCH AS CUTTING, SCRIBING, AND MARKING, AS WELL AS REMOTE SENSING.

QUAN-SCAN INC
959 E WALNUT ST - #110
PASADENA, CA 91106
CONTRACT NUMBER:
DR PAUL E WEST
TITLE:
MASSIVE DENSE DATA STORAGE AND RETRIEVAL UTILIZING SCANNING
TUNNELING MICROSCOPE TECHNOLOGY
TOPIC# 10 OFFICE: IDENT#: 38619

NEW AND INNOVATIVE TECHNIQUES FOR MASSIVE DATA STORAGE AND RETRIEVAL ARE BEING SOUGHT. BY UTILIZING SCANNING TUNNELING MICROSCOPE TECHNOLOGY, IT IS POSSIBLE TO DEVELOP MASS STORAGE SUBSYSTEMS WITH DENSITIES 10,000 TIMES GREATER THAN OPTICAL DISK SUBSYSTEMS. IN THIS INVESTIGATION, THE FEASIBILITY OF DEVELOPING AN ERASABLE STORAGE MEDIUM FOR AN STM BASED ULTRADENSE MASS STORAGE SYSTEM IS BEING DETERMINED.

QUANTUM TECHNOLOGY INC
830 FRANKLIN CT
MARIETTA, GA 30067
CONTRACT NUMBER:
DR DAVID M WALKER
TITLE:
SINGLE HIGH RESOLUTION GAMMA RAY DETECTORS
TOPIC# 3 OFFICE: IDENT#: 38628

GAMMA RAY ENERGY IS A UNIQUE CHARACTERISTIC OF A GIVEN RADIATION SOURCE WHICH ALLOWS POSITIVE IDENTIFICATION OF GAMMA RAYS FROM THAT SOURCE IN A COMPLEX INCIDENT RADIATION BEAM OF MIXED RADIATION.

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DETECTION SENSITIVITY FOR AN ENERGY-SPECIFIC GAMMA RAY DETECTOR IS USUALLY LIMITED BY THE NUMBER OF NON-INFORMATIVE COUNTS RECORDED IN WHICH PART OF THE ENERGY OF THE INCIDENT GAMMA RAY ESCAPES FROM THE DETECTOR. STRIKING IMPROVEMENTS IN THE REDUCTION OF NON-INFORMATIVE COUNTS CAN BE REALIZED IF ACCEPTANCE CRITERIA BASED ON THE TYPE OF GAMMA RAY INTERACTION OR THE INTERACTION SEQUENCE COULD BE IMPOSED. BASED ON RECENT ADVANCEMENTS IN SENSOR TECHNOLOGY, LOW NOISE ELECTRONICS, AND THE AVAILABILITY OF POWERFUL, LOW COST MICRO-PROCESSORS, METHODS TO IMPLEMENT DYNAMIC SEQUENCE/EVENT ANALYSIS IN SINGLE DETECTOR VOLUMES ARE BEING EVALUATED. MONTE CARLO MODELS ARE BEING USED TO PREDICT DETECTOR PERFORMANCE FOR VARIOUS DETECTOR GEOMETRIES, INCIDENT GAMMA BEAMS, AND COUNT REJECTION CRITERIA, AND IN SELECTION OF DETECTOR DESIGNS FOR EXPERIMENTAL EVALUATION. WHEN SUCCESSFUL, SIGNIFICANTLY IMPROVED DETECTOR SENSITIVITIES FOR SINGLE, HIGH-RESOLUTION GAMMA RAY DETECTORS WOULD RESULT. THIS DEVELOPMENT WOULD PROVIDE IMPROVED CAPABILITIES FOR SCIENTIFIC APPLICATIONS, AND PERFORMANCE ENHANCEMENTS WITH GREATLY REDUCED WEIGHT AND COMPLEXITY FOR MILITARY SURVEILLANCE APPLICATIONS.

RADIATION SCIENCE INC

PO BOX 293

BELMONT, MA 02178

CONTRACT NUMBER:

DR ALLEN S KRIEGER

TITLE:

HIGH BRIGHTNESS HARD X-RAY SOURCE . R INTERACTIVE DISCRIMINATION

TOPIC# 3

OFFICE:

IDENT#: 38631

CHANNELING RADIATION IS PRODUCED WHEN A BEAM OF ENERGETIC ELECTRONS TRAVELS THROUGH A CRYSTAL IN A DIRECTION PARALLEL TO ONE OF ITS LATTICE PLANES OR AXES. THE RESULTING HARD X-RAY PHOTONS EMERGE WITH AN INTENSITY NEARLY EQUAL TO THE BEAM FROM A SYNCHROTRON X-RAY SOURCE. BECAUSE THE X-RAYS ARE EMITTED AS A NARROW CONE, ALL THE PHOTONS CAN BE COLLECTED AND DIRECTED TOWARD A DISTANT OBJECT BY SPECIALIZED X-RAY OPTICS. THE RESULT IS AN INTENSE BEAM OF HARD X-RAYS WHICH COULD ILLUMINATE AN EXO-ATMOSPHERIC TARGET FOR INTERACTIVE DISCRIMINATION BASED ON CHANNELING RADIATION. A CHANNELING RADIATION SOURCE WOULD PRODUCE A MORE INTENSE BEAM OF HARD X-RAY PHOTONS THAN CAN BE OBTAINED FROM AN X-RAY TUBE. IT

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WOULD BE A KEY COMPONENT OF AN INTERACTIVE DISCRIMINATION SYSTEM.
IT MIGHT ALSO BE A USEFUL LABORATORY SOURCE FOR EXPERIMENTS THAT CAN
NOW BE PERFORMED ONLY AT SYNCHROTRON RADIATION FACILITIES, E.G. X-RAY
MICRO-PROBE ANALYSIS, X-RAY TOPOGRAPHY, ULTRA HIGH RESOLUTION X-RAY
TOMOGRAPHY, AND TIME RESOLVED X-RAY DIFFRACTION ANALYSIS.

RASOR ASSOCS INC
253 HUMBOLDT CT
SUNNYVALE, CA 94089
CONTRACT NUMBER:
DR NED S RASON
TITLE:
CESIUM VAPOR CONTROL CIRCULATION AND PURGE
TOPIC# 4 OFFICE: IDENT#: 38633

THE CESIUM RESERVOIRS FOR THE THERMIONIC REACTOR SYSTEMS PRESENTLY
UNDER DEVELOPMENT IMPOSE SIGNIFICANT DESIGN CONSTRAINTS AND STABILITY
UNCERTAINTIES. A NEW TYPE OF LIQUID CESIUM RESERVOIR HAS BEEN
CONCEIVED THAT MAINTAINS A TEMPERATURE-INDEPENDENT CESIUM PRESSURE,
CONTINUOUSLY RECIRCULATES CESIUM VAPOR THROUGH THE THERMIONIC FUEL
ELEMENTS (TFE) AND PURGES IT OF IMPURITIES. THIS DEVICE, THE
"CESIATOR", IS BASED ON WELL-ESTABLISHED GAS-BUFFERED HEAT PIPE
PRINCIPLES. THE CESIATOR OFFERS NEW TFE DESIGN OPTIONS FOR FISSION
PRODUCT/IMPURITY HANDLING THAT ELIMINATE THE NEED FOR AN INTERCELL
INSULATOR-SEAL AND ASSOCIATED FAILURE MODES. IN THIS STUDY, CESIATOR
PERFORMANCE REQUIREMENTS ARE BEING ESTIMATED BASED ON DATA FOR
EXPECTED RELEASE OF FISSION PRODUCTS AND THEIR EFFECT TFE PERFORMANCE.
AN ANALYTICAL MODE IS BEING DEVELOPED THAT DESCRIBES THE EFFECT OF
DESIGN PARAMETERS ON CESIATOR PERFORMANCE. VALIDITY OF THE MODEL AND
OPTIMUM CESIATOR DESIGN ARE BEING CONFIRMED QUANTITATIVELY IN TESTS
OF A CEISTOR MOCKUP, WHICH ALSO IS A DELIVERABLE ITEM FOR VISUAL
DEMONSTRATION OF OPERATING PRINCIPLES. THE DATA AND DESIGN
PRINCIPLES DEVELOPED WILL BE USED TO PREPARE A DETAILED PROGRAM
PLAN FOR DEVELOPMENT AND TEST OF A PROTOTYPE CEISATOR IN LATER
RESEARCH SUITABLE FOR USE IN SUBSEQUENT TFE IN-CORE TESTS. THIS
RESEARCH, WHEN SUCCESSFUL, WOULD ESTABLISH A VERSATILE OPTION FOR A
CRITICAL COMPONENT IN THE THERMIONIC NUCLEAR REACTOR SYSTEMS
PRESENTLY UNDER DEVELOPMENT FOR SPACE POWER REQUIREMENTS. THE
CESIATOR WOULD HAVE SIMILAR GENERIC IMPORTANCE FOR ALL FUTURE SPACE

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AND TERRESTRIAL APPLICATIONS OF THERMIONIC CONVERSION TECHNOLOGY,
AND FOR ALL DEVICES REQUIRING A CONTROLLED CESIUM VAPOR ATMOSPHERE.

RASOR ASSOCS INC
253 HUMBOLDT CT
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CONTRACT NUMBER:

JOHN McVEY

TITLE:

PULSED IONIZATION THERMIONIC CONVERTERS FOR NUCLEAR POWER
APPLICATIONS

TOPIC# 4

OFFICE:

IDENT#: 38636

THERE IS A NEED FOR A SPACE POWER SYSTEM WHICH CAN OPERATE AT LOWER TEMPERATURES. THERMIONICS OFFERS THIS POSSIBILITY. STATE-OF-THE-ART THERMIONIC ENERGY CONVERTERS (DIODES) HAVE AN INTERNAL PLASMA MAINTENANCE POWER REQUIREMENT OR ARC DROP WHICH RESULTS IN REDUCE dc OUTPUT VOLTAGE WHEN OPERATING AT LOW TEMPERATURES. THE PULSED-IONIZATION DIODE HAS BEEN STUDIED AS A METHOD OF INCREASING THE OUTPUT VOLTAGE BY REDUCING THE ARC-DROP. HOWEVER, EFFICIENCY OF THE PULSE METHOD DEPENDS UPON ATTAINING LONG PLASMA DECAY TIMES (PERIODS OF USEFUL POWER OUTPUT) WITHOUT ADVERSE PARASITIC EFFECTS. IN THIS STUDY, THE USE OF VIBRATIONALLY-EXCITED MOLECULAR NITROGEN IS BEING DEMONSTRATED TO ATTAIN LONG PLASMA DECAY TIMES IN A THERMIONIC ENERGY DIODE. IN THE NITROGEN-ENHANCED PULSED DIODE, THE PULSE ENERGY IS STORED IN VIBRATIONAL STATES OF MOLECULAR NITROGEN WHICH HAVE A HIGH PROBABILITY OF IONIZING THE CESIUM FILLER. LITERATURE DEALING WITH NITROGEN ENHANCEMENT IS BEING COLLECTED AND EVALUATED. AN EXISTING EXPERIMENTAL SET-UP IS BEING USED TO TEST THE EFFECT OF NITROGEN PRESSURE ON PERFORMANCE. FEASIBILITY OF THIS APPROACH TO IMPROVE CONVERTER PERFORMANCE IS BEING DETERMINED AND RANGE OF SUCH CONVERTERS TO LOWER EMITTER TEMPERATURES IS BEING EXTENDED. THERMIONIC ENERGY CONVERSION IS A MAJOR CONTENDER FOR LONG-TERM SPACE FLIGHT. THIS SYSTEM, WHEN SUCCESSFUL, USED IN COMBINATION WITH NUCLEAR FISSION REACTOR CONVERTS HEAT DIRECTLY TO ELECTRICITY. THE THRUST OF THIS EFFORT IS TO SIMPLIFY CONVERTER DESIGN AND MAKE IT MORE COMPATIBLE WITH THE LONG RANGE STRATEGIC DEFENSE PLANS. SUCCESSFUL DEVELOPMENT WOULD IMPACT SPACE REACTOR DESIGN ISSUES BY INCREASING PERFORMANCE AND OPTIMIZING CELL LENGTH. THERMIONIC ENERGY

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CONVERSION HAS BEEN CONSIDERED FOR COMMERCIAL POWER PLANT TOPPING
CYCLE APPLICATIONS.

ROCKY RESEARCH
674 WELLS RD
BOULDER CITY, NV 89005
CONTRACT NUMBER:
UWE ROCKENFELLER
TITLE:
SELF-CONTAINED SOLID-VAPOR HEAT PUMP CYCLES FOR CENTRAL HEAT
TRANSFER BUS
TOPIC# 7 OFFICE: IDENT#: 38650

FOR THERMAL LOADS CLOSE TO, BUT DIFFERENT FROM, THE OPERATING
TEMPERATURE OF A CENTRAL HEAT TRANSFER BUS, HEAT PUMPS ARE NEEDED TO
SPACE THE TEMPERATURE DIFFERENCE. THE LACK OF GRAVITY IN SPACE WITH
THE ASSOCIATED PHASE SEPARATION PROBLEMS, AS WELL AS EFFICIENCY AND
RELIABILITY REQUIREMENTS CAUSE SEVERE PROBLEMS WITH VAPOR COMPRESSION
AND LIQUID-VAPOR ABSORPTION CYCLES. LIQUID-VAPOR ABSORPTION CYCLE
EFFICIENCIES ARE LIMITED BY THEIR STAGING AND DO NOT BENEFIT FROM
LOW LIFT APPLICATIONS AS ENCOUNTERED IN THE ENVISIONED APPLICATION.
IN THIS STUDY, A CONSTANT PRESSURE, ENGINE-STAGED, SOLID-VAPOR HEAT
PUMP, IS BEING DEVELOPED WHICH DOES NOT DEPEND ON GRAVITY, HAS NO
PHASE SEPARATION REQUIREMENTS OR MOVING PARTS, AND CAN BE HEAT OR
COMPRESSOR ACTIVATED. STAGING IS BEING OBTAINED WITH A VARIETY OF
COORDINATIVE COMPLEX COMPOUNDS WHICH LEADS TO CYCLE EFFICIENCIES
SUPERIOR TO CONVENTIONAL SYSTEMS AND PERFORMANCE INCREASES WITH
DECREASING TEMPERATURES LIFT REQUIREMENTS. THE RESEARCH IS FOCUSING
ON THE CYCLE AND MEDIA DEVELOPMENT FOR HIGH EFFICIENCY OPERATION. IN
THIS EFFORT, THE NECESSARY WORKING MEDIA, ARE BEING IDENTIFIED; A
PROOF-OF-PRINCIPLE HARDWARE DEMONSTRATION IS BEING PERFORMED; AND,
THE HEAT PUMP PERFORMANCE IS BEING DETERMINED BY COMPUTER MODELING.
MEDIA PROPERTY OPTIMIZATION AND A BREADBOARD PROOF-OF-CONCEPT HEAT
PUMP WILL BE ADDRESSED AT A LATER EFFORT. WHEN SUCCESSFUL, THE
DEVELOPMENT OF CONSTANT PRESSURE ENGINE STAGED SOLID-VAPOR HEAT PUMP
CYCLES FOR COMMERCIAL HVAC, REFRIGERATION AND INDUSTRIAL WASTE HEAT
RECOVERY WOULD BE DIRECTLY APPLICABLE AND COMMERCIALY VIABLE.

RTS LABS INC
1663 TECHNOLOGY AVE
ALACHUA, FL 32615
CONTRACT NUMBER:
RICHARD T SCHNEIDER
TITLE:
NUCLEAR DRIVEN MAGNETOHYDRODYNAMIC POWER GENERATION
TOPIC# 4 OFFICE: IDENT#: 38654

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DEVELOPMENT OF A DEVICE PROVIDING A METAL VAPOR JET AT TEMPERATURES UP TO 3000 K IS BEING INVESTIGATED. THE DEVICE IS FULLY INSTRUMENTED TO ALLOW MEASUREMENT OF TEMPERATURE, ELECTRICAL CONDUCTIVITY, MASS FLOW AND PRESSURES. THE APPLICATION OF THE DEVICE IS FOR RESEARCH CONCERNING NUCLEAR DRIVEN MAGNETOHYDRODYNAMIC (MHD) POWER GENERATION. NUCLEAR REACTIONS CAN BE SIMULATED EITHER BY BOMBARDMENT WITH FAST ELECTRONS OR FAST HEAVY IONS. NUCLEAR REACTION COULD ALSO BE PERFORMED IN THE METAL JET ITSELF BY PLACING IT NEXT TO A NUCLEAR REACTOR. SUCH A DEVICE WOULD HAVE APPLICATIONS IN THE FIELD OF ENERGY RESEARCH. UTILIZING HIGH TEMPERATURE FAST FLOWING GAS ONLY, THE DEVICE, WHEN SUCCESSFUL, COULD BE USED FOR MATERIALS STUDIES, ABSORPTION SPECTROSCOPY, AND DEVELOPMENT OF HIGH TEMPERATURE PRESSURE GAGES AND FLOW METERS. IN COMBINATION WITH AN ELECTRON GUN, IT COULD BE USED FOR STUDIES OF REACTION KINETICS OF CONDITIONS. IN CONJUNCTION WITH A NEUTRON SOURCE, THE DEVICE COULD BE USED FOR BASIC RESEARCH IN NUCLEAR ENGINEERING. WHEN USED WITH HEAVY ION ACCELERATOR STUDIES CONCERNING FISSION FRAGMENTS COULD BE DONE.

SCHMIDT INSTRUMENTS
2474 BOLSOVER - STE 234
HOUSTON, TX 77005
CONTRACT NUMBER:
DR HOWARD K SCHMIDT

TITLE:
IN SITU CHARACTERIZATION OF DIAMOND SURFACES DURING LOW PRESSURE
CHEMICAL VAPOR DEPOSITION
TOPIC# 14 OFFICE: IDENT#: 38668

THE CHEMICAL MECHANISMS OF CHEMICAL VAPOR DEPOSITION (CVD) OF DIAMOND AND OTHER ELECTRONIC MATERIALS ARE AT BEST POORLY UNDERSTOOD. DURING PHASE I, WE SHALL CONSTRUCT A LOW PRESSURE CHEMICAL VAPOR DEPOSITION (LPCVD) REACTOR EQUIPPED WITH AN ION BEAM SURFACE PROBE AND DEMONSTRATE ITS UTILITY IN DETERMINING SURFACE STOICHIOMETRIES UNDER ACTUAL DEPOSITION CONDITIONS IN-SITU. THE GOAL IS TO PERFECT AND USE SUCH EQUIPMENT TO INVESTIGATE THE MECHANISM AND KINETICS OF HOMO-EPITAXIAL DIAMOND GROWTH. INSIGHTS INTO THE DEPOSITION CHEMISTRY OF DIAMOND OBTAINED BY THIS METHOD WILL ENABLE THE DEVELOPMENT OF IMPROVED TECHNIQUES FOR MANUFACTURING SINGLE CRYSTAL

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DIAMOND FILM. NEW ELECTRONIC APPLICATIONS OF DIAMOND MAY BECOME PRACTICAL AND COMMERCIALIZABLE AS A RESULT OF THIS EFFORT.

SCHWARTZ ELECTRO-OPTICS INC
3404 N ORANGE BLOSSOM TRAIL
ORLANDO, FL 32804
CONTRACT NUMBER:
DR MADHU A ACHAREKAR
TITLE:
LASER GUIDANCE AND FUZING SUBSYSTEM FOR KINETIC ENERGY WEAPONS
TOPIC# 2 OFFICE: IDENT#: 38671

KINETIC ENERGY WEAPONS SYSTEMS SUCH AS GROUND-BASED EXOATMOSPHERIC RE-ENTRY VEHICLE INTERCEPTORS (ERIS) AND SPACE BASED INTERCEPTORS (SBI) PRESENTLY DO NOT USE LASER GUIDANCE AND FUZING SUBSYSTEM. IN THE HIGH AND ATMOSPHERIC DEFENSE INTERCEPTOR (HEDI) UNIT, A LASER IS USED, HOWEVER THIS GIMBAL-MOUNTED LASER IS EXPENSIVE AND IS OF SUBSTANTIAL SIZE AND WEIGHT. THE FEASIBILITY IS BEING INVESTIGATED OF AN ACTIVE (LASER ON THE INTERCEPTOR) GUIDANCE AND FUZING SUBSYSTEM USING A CHEMICAL FLASHLAMP PUMPED NEODYMIUM:CHROMIUM:GSGG LASER. THE LASER MATERIAL SHOWS A RADIATION HARDNESS LEVEL DESIRED FOR THIS APPLICATION. THE BULK OF THE PROGRAM CONSISTS OF AN EXPERIMENTAL DEMONSTRATION OF COMPLETE LASER PACKAGED IN LESS THAN ONE CUBIC INCH VOLUME. LOW COST/LOW MASS CHEMICAL PUMPED SOLID STATE LASERS HAVE VARIOUS POTENTIAL APPLICATIONS FROM VERY HIGH POWER LASERS FOR FUSION TO MINIATURE LASERS FOR DESIGNATORS, PARTICULARLY IN SPACE AND TRANSATMOSPHERIC SYSTEMS WHERE INPUT POWER REQUIREMENT AND SYSTEM WEIGHT ARE PRIME CONSIDERATIONS.

SCIENCE RESEARCH LAB INC
15 WARD ST
SOMERVILLE, MA 02143
CONTRACT NUMBER:
DANIEL BIRX
TITLE:
ALL SOLID STATE RADIO-FREQUENCY PULSE GENERATOR FOR DRIVING COMPACT SPACE-BASED CARBON-DIOXIDE LASERS
TOPIC# 3 OFFICE: IDENT#: 38674

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THERE IS CONSIDERABLE INTEREST IN THE DESIGN AND FABRICATION OF COMPACT, RELIABLE CO2 LASERS FOR AIRBORNE AND SPACE-BASED LASER RADAR APPLICATIONS. SPECIFICALLY, THE SPACE-BASED INTERCEPTOR PROGRAM HAS A REQUIREMENT FOR A COMPLETE LASER RADAR SYSTEM WEIGHING LESS THAN 200 KG AND RELIABLE ENOUGH TO OPERATE IN SPACE FOR YEARS WITHOUT MAINTENANCE. RF PUMPED CO2 DISCHARGE LASERS CAN BE OPERATED AS A SEALED SYSTEM WITH NO ELECTRODES IN CONTACT WITH THE LASER DISCHARGE AND NO GAS FLOW LOOP. ENERGY IS COUPLED CAPACITIVELY THROUGH THE CERAMIC WALLS OF THE DISCHARGE CAVITY, THEREBY ELIMINATING ELECTRODE WEAR AND GAS CONTAMINATION PROBLEMS ASSOCIATED WITH STANDARD DC PUMPED DISCHARGE TEA LASERS. A NEW, ALL-SOLID-STATE RF PULSE GENERATOR IS BEING INVESTIGATED FOR AN EFFICIENT, RELIABLE, COMPACT, PULSE RF POWER SOURCE TO PUMP CO2 DISCHARGE LASERS. THIS FROZEN NONLINEAR MAGNETIC PULSE COMPRESSOR TECHNOLOGY WHICH WILL BE FULLY COMPATIBLE WITH THE PRESENT HIGH POWER CO2 DISCHARGE LASERS CURRENTLY UNDER DEVELOPMENT AND WILL SERVE AS A BASIS FOR FUTURE DRIVERS DESIGNED TO POWER LASERS FOR AIRBORNE AND SPACEBORNE APPLICATIONS. WHEN SUCCESSFUL, THIS SOLID STATE, RF LASER DRIVER TECHNOLOGY WOULD BE A SIGNIFICANT IMPROVEMENT IN RELIABILITY OVER PRESENTLY-USED DC PULSED CO2 LASERS. IN ADDITION TO LASER RADAR APPLICATIONS, AN IMPROVEMENT IN CO2 LASER TECHNOLOGY WOULD SUPPORT A BROAD SPECTRUM OF MILITARY AND CIVILIAN APPLICATIONS INCLUDING LASER COMMUNICATIONS, LASER RANGEFINDERS, LASER TARGET DESIGNATORS AND LASER SURGERY.

SCIENCE RESEARCH LAB INC
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SOMERVILLE, MA 02143

CONTRACT NUMBER:

JONAH JACOB

TITLE:

EXPANDING BEAM LASER AMPLIFIER FOR SCALING HIGH POWER LASERS

TOPIC# 1

OFFICE:

IDENT#: 38677

THE EXPANDING BEAM LASER (EBL) AMPLIFIER CONCEPT IS BEING INVESTIGATED AS A METHOD FOR EFFICIENT LENGTH SCALING OF VARIOUS LASERS TO THE MULTI-MEGAWATT AVERAGE POWER LEVELS REQUIRED FOR STRATEGIC APPLICATIONS. THE EBL AMPLIFIER CONCEPT IS EXPECTED TO

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INCREASE THE STAGE GAIN WHICH COULD BE EFFICIENTLY OBTAINED FROM A POWER AMPLIFIER BY FACTORS OF 10-30 SO THAT INTERMEDIATE AMPLIFIERS COULD BE ELIMINATED IN THE MOPA CHAIN. SUCH A SIMPLIFICATION OF THE SYSTEM ARCHITECTURE WOULD RESULT IN SIGNIFICANT COST SAVING AND INCREASED RELIABILITY. ADDITIONAL ADVANTAGES INCLUDE REDUCED BEAM QUALITY SENSITIVITY TO LASER MEDIUM INHOMOGENEITIES, A SIMPLIFIED OPTICAL SYSTEM AND REDUCED LEVELS OF AMPLIFIED SPONTANEOUS EMISSION. THE ADVANTAGES OF THE EBL AMPLIFIER LEAD TO A REDUCTION IN COST FOR HIGH AVERAGE POWER RATE GAS HALIDE LASER SYSTEMS BY A FACTOR OF 3 AND HAVE THE POTENTIAL TO MAKE THESE LASERS COST COMPETITIVE WITH OTHER GROUND BASED-LASER (GBL) APPROACHES FOR STRATEGIC DEFENSE APPLICATIONS. A CONCEPTUAL DESIGN FOR AN ULTRA-HIGH POWER EXCIMER LASER SYSTEM IS BEING COMPLETED TO GUIDE THE DESIGN OF A LABORATORY SCALE MULTIPASS XENON CHLORIDE (XeCl) LASER EXPERIMENT WHICH WILL DEMONSTRATE THE FAVORABLE LENGTH SCALING FEATURES OF THE EBL ARCHITECTURE. LASER SYSTEM COSTS ARE ALSO BEING COMPARED FOR CONVENTIONAL AND EBL DESIGNS. VALIDATION OF THE EXPANDING BEAM LASER AMPLIFIER CONCEPT WOULD SIGNIFICANTLY REDUCE THE COST OF MULTI-MEGAWATT AVERAGE POWER LASERS FOR STRATEGIC DEFENSE APPLICATIONS. THESE LASER SYSTEMS WILL THEN BE COST COMPETITIVE AS AN ATTRACTIVE ALTERNATE CANDIDATE FOR GBL APPLICATIONS.

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CONTRACT NUMBER:
DANIEL BIRX

TITLE:
INDUCTION LINAC DRIVEN FREE ELECTRON LASER WITH FERRITE MATERIALS
TOPIC# 1 OFFICE: IDENT#: 38678

PROPERTIES OF FERRITE MATERIALS PLAY A KEY ROLE IN THE DESIGN OF BOTH ACCELERATOR CELLS AND DRIVERS FOR INDUCTION LINAC DRIVEN FREE ELECTRON LASERS (ILFELs). TIME-DEPENDENT HYSTERESIS LOSSES, COMBINED WITH THERMAL CONDUCTIVITY, CURIE POINT, AND GEOMETRY OF THE FERRITE CORE PLACE LIMITATIONS ON BOTH ACCELERATOR PULSE LENGTH AND DUTY FACTOR. THIS IN TURN IMPACTS THE AVERAGE OUTPUT POWER, EFFICIENCY AND COST OF THE ACCELERATOR. NONLINEAR MAGNETIC DRIVERS ARE EVOLVING TO THE POINT WHERE THE FERRITE IN THE ACCELERATOR CELLS

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IS NOW THE PRIMARY CONSTRAINT TO OPERATING AT INCREASED REPETITION RATES. LOSSES IN THE FERRITE ARE ALSO REDUCING THE EFFICIENCY AND THE MINIMUM ACHIEVABLE ENERGY SPREAD OF THE ELECTRON BEAM. AN OPTIMIZED FERRITE COMPOSITION IS BEING DETERMINED IN THIS STUDY THROUGH ANALYSIS AND EXPERIMENTATION. AN OPTIMUM GEOMETRY IS ALSO BEING ESTABLISHED, WITH THE FERRITE SELECTED, TO FACILITATE WASTE HEAT REMOVAL. IMPROVEMENTS IN INDUCTION LINEAR ACCELERATOR CELL DESIGN COULD SUBSTANTIALLY INCREASE THE PERFORMANCE OF ILFELS AND AT THE SAME TIME LEAD TO DECREASED COSTS. INDUCTION LINACS HAVE APPLICATION IN DRIVING RELATIVISTIC KLYSTRONS AS ADVANCED RF POWER SOURCES FOR A WIDE SPECTRUM OF TACTICAL MILITARY APPLICATIONS INCLUDING JAMMING, ELECTRONIC KILL AND SPACE BASED RADAR, AND IN DRIVING SPACE BASED FREE ELECTRON LASERS FOR STRATEGIC APPLICATIONS. COMMERCIAL APPLICATIONS INCLUDE ELECTRON CYCLOTRON HEATING OF TOKOMAK PLASMAS.

SCIENTIFIC COMPUTING ASSOCS INC
246 CHURCH ST - STE 307
NEW HAVEN, CT 06510
CONTRACT NUMBER:
DONALD BERNDT
TITLE:
ADA-LINDA PARALLEL PROGRAMMING ENVIRONMENT
TOPIC# 10 OFFICE: IDENT#: 38680

AN ADA-LINDA PARALLEL PROGRAMMING ENVIRONMENT IS BEING DEVELOPED IN THIS INVESTIGATION. LINDA IS A SET OF PARALLEL PROCESS MANAGEMENT OPERATIONS THAT COULD BE INSERTED INTO AN EXISTING SERIAL PROGRAMMING LANGUAGE SUCH AS C OR FORTRAN, AND PROVIDE CONVENIENT ACCESS TO PARALLELISM FROM WITHIN A FAMILIAR HIGH-LEVEL LANGUAGE. LINDA'S TUPLE SPACE IS SIMULTANEOUSLY A MORE POWERFUL AND SIMPLER INTER PROCESS COMMUNICATION MECHANISM THAN ADA'S RENDEZVOUS. COMMUNICATION IS BASIC TO PARALLEL AND DISTRIBUTED PROGRAMMING; THUS, ADA-LINDA IS EXPECTED TO BE A SIMPLER AND MORE POWERFUL PROGRAMMING VEHICLE THAN ADA. IN ADDITION TO BEING EASILY LEARNED, LINDA WOULD PROVIDE PORTABILITY; THE PROGRAMMER NEED NOT CONCERN HIMSELF WITH THE UNDERLYING PARALLEL ARCHITECTURE. WHEN SUCCESSFUL, LINDA WOULD BE AN ATTRACTIVE SOFTWARE PRODUCT FOR A VARIETY OF PARALLEL MULTIPROCESSOR COMPUTERS. ADA-LINDA HAS THE

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POTENTIAL TO MAKE EXTREMELY FAST (BUT CORRESPONDINGLY COMPLEX)
HARDWARE CONFIGURATIONS PROGRAMMABLE FOR THE TYPICAL
APPLICATIONS-ORIENTED SCIENTIFIC ORGANIZATION. THIS POTENTIAL WOULD
MAKE ADA-LINDA VALUABLE IN A WIDE RANGE OF APPLICATIONS REQUIRING
LARGE-SCALE COMPUTATION.

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DR SALVADOR M FERNANDEZ
TITLE:
ACOUSTO-OPTIC TUNABLE ULTRAVIOLET SNESOR
TOPIC# 2 OFFICE: IDENT#: 38683

THE EFFECTIVENESS OF KINETIC ENERGY SPACE-BASED INTERCEPTOR MAY BE
CONSIDERABLY ENHANCED BY ON-BOARD UV SENSORS CAPABLE OF DETECTING
A POTENTIAL TARGET'S UV SIGNATURE. SUCH UV SENSORS MAY PLAY A
CRITICAL ROLE IN TARGET IDENTIFICATION, TRACKING, SEEKING AND
DISCRIMINATION AND MAY PROVE INSTRUMENTAL FOR EARLY WARNING OF
ATTACK AND KILL DETERMINATION. SPACE-BASED APPLICATIONS, IN
PARTICULAR, HAVE CREATED AN URGENT NEED FOR MINIATURE TUNABLE IMAGING
UV SENSORS. IN THIS INVESTIGATION, ACOUSTO-OPTIC TECHNIQUES ARE
BEING USED TO DEVELOP A SMALL SIZE, LOW MASS ACOUSTO-OPTIC TUNABLE
UV FILTER (AOTF) WITH HIGH SPECTRAL RESOLUTION, RAPID WAVELENGTH
SCANNING CAPABILITY AS WELL AS RANDOM ACCESS WAVELENGTH SELECTION,
AND TWO-DIMENSIONAL SPECTRALLY-RESOLVED IMAGING CAPABILITY. THE AOTF
ESSENTIALLY CONSISTS OF A PIEZOELECTRIC TRANSDUCER BONDED TO A
BIREFRINGENT CRYSTAL. EXCITATION OF THE TRANSDUCER BY AN APPLIED RF
MODULATES THE INDEX OF REFRACTION VIA THE ELASTO-OPTIC EFFECT. THIS
GENERATES A MOVING PHASE GRADIENT WHICH UNDER PROPER CONDITIONS
WOULD DIFFRACT PORTIONS OF AN INCIDENT LIGHT BEAM. BOTH COLLINEAR
AND NON-COLLINEAR CONFIGURATIONS ARE BEING INVESTIGATED TO ACHIEVE
NON-CRITICAL PHASE MATCHING. DESIGN PARAMETER TRADE-OFFS ARE BEING
AIMED AT MINIMIZING THE SIZE OF THE DEVICE. CHARGE-COUPLED DEVICE
(CCD) ARRAYS AND MICROCHANNEL ARRAY-MULTIANODE DETECTORS ARE BEING
EVALUATED. FAST GATE CCD ARRAYS WITH POTENTIAL FOR 100% QUANTUM
EFFICIENCY IN THE UV ARE RECEIVING SPECIAL ATTENTION. SUCCESSFUL
DEVELOPMENT OF THE AOTF UV SENSOR WOULD COMBINE THE SPATIAL IMAGING

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CAPABILITY OF AN INTERFERENCE FILTER AND THE TUNABILITY OF A GRATING SPECTROMETER WITH A SIZE/MASS REDUCTION OF AT LEAST TWO ORDERS OF MAGNITUDE OVER CURRENTLY AVAILABLE SYSTEMS. ANTICIPATED BENEFITS EXIST IN SPACE-BASED INTERCEPTORS, WHERE SMALL SIZE AND MASS ARE OF CRITICAL IMPORTANCE. ADDITIONAL APPLICATIONS INCLUDE GEOPHYSICAL STUDIES, LIDAR REMOTE DETECTION OF ATMOSPHERIC CONSTITUENTS, AND ANALYTICAL FLUORESCENCE SPECTROSCOPY.

SCIENTIFIC SYSTEMS INC
ONE ALEWIFE PL
CAMBRIDGE, MA 02140
CONTRACT NUMBER:
DK RAMAN K MEHRA
TITLE:

FLEXIBLE LARGE SPACE STRUCTURE ADAPTIVE CONTROL FOR ACCURATE
POINTING AND TRACKING
TOPIC# 12 OFFICE: IDENT#: 38690

THE ACCURACY REQUIREMENTS ON THE POINTING AND TRACKING FUNCTIONS FOR FLEXIBLE LARGE SPACE STRUCTURES (LSS) CARRYING DIRECTED ENERGY WEAPONS, SUCH AS LASERS AND PARTICLE BEAMS, ARE SEVERAL ORDERS OF MAGNITUDE HIGHER THAN THE CURRENT STATE OF THE ART. FLEXIBLE LSS ARE VERY LIGHTLY DAMPED, AND THEIR DYNAMIC CHARACTERISTICS CAN CHANGE ABRUPTLY. RECENT RESEARCH SHOWS THAT NON-ADAPTIVE CONTROLLERS CANNOT STABILIZE LSS UNDER CHANGING DYNAMIC CHARACTERISTICS SUCH AS POLE-ZERO FLIPS. THIS STUDY INVESTIGATES THE ACCURACY OF AN APPROACH CALLED ADAPTIVE MODEL ALGORITHMIC CONTROL (AMAC), WHICH HAS RECENTLY BEEN SHOWN TO BE EFFECTIVE FOR ADAPTIVE WING-STORE FLUTTER CONTROL ON F-16 AIRCRAFT. AMAC USES A POWERFUL, COMPUTATIONALLY EFFICIENT SPACE SYSTEM IDENTIFICATION METHOD BASED ON A CANONICAL VARIATE ANALYSIS (CVA). IT HAS BEEN SHOWN THAT CVA CAN IDENTIFY DYNAMIC STRUCTURAL CHARACTERISTICS UNDER UNSTABLE AND CLOSED-LOOP CONTROL CONDITIONS. SINCE OTHER RECURSIVE IDENTIFICATION TECHNIQUES FAIL UNDER THESE CONDITIONS, THEY ARE NOT SUITABLE FOR ADAPTIVE CONTROL OF LSS. IN THIS STUDY AMAC IS BEING APPLIED TO A SET OF DIFFICULT LSS CONTROL PROBLEMS USING NON-COLLOCATED SENSORS AND ACTUATORS. IN ADDITION TO THE PROBLEM OF ACTIVE STRUCTURAL DAMPING, CONTROL UNDER RAPID SLEWING MANEUVERS IS BEING STUDIED. THE ROBUSTNESS OF THE ADAPTIVE CONTROLLERS TO NEGLECTED MODES IS BEING EXAMINED. THE REQUIREMENTS

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FOR SENSOR AND ACTUATOR BANDWIDTH AND ACCURACY ARE ALSO BEING DETERMINED. THE AMAC COMBINED TWO POWERFUL MODERN APPROACHES TO IDENTIFICATION AND ACTIVE CONTROL. THE SUCCESS OF AMAC FOR CONTROL OF FLEXIBLE LSS COULD ALSO LEAD TO MANY COMMERCIAL APPLICATIONS IN OTHER SPACE VEHICLES AND IN THE FIELD OF ROBOTICS.

SIERRA MONOLITHICS INC
107 W TORRANCE BLVD - STE 204
REDONDO BEACH, CA 90277
CONTRACT NUMBER:
DR BINNEG Y LAO

TITLE:

NON-VOLATILE RAD-HARD HIGH-SPEED HIGH-DENSITY LOW POWER RANDOM
ACCESS MEMORY ON SILICON
TOPIC# 10 OFFICE: IDENT#: 38698

A MONOLITHIC NON-VOLATILE, LOW POWER, HIGH SPEED, AND HIGH DENSITY STATIC RANDOM ACCESS MEMORY (RAM) IS BEING INVESTIGATED USING SILICON (Bi-MOS) TECHNOLOGY. IT HAS THE SAME NON-VOLATILITY THAT CORE MEMORY OFFERS BUT WITH GREATLY REDUCED POWER CONSUMPTION. IT DOES NOT HAVE LIMITED LIFE-CYCLE PROBLEMS. THE ACCESS TIME IS ESTIMATED TO BE AROUND 15ns. A .28"x28" CHIP CAN ACCOMMODATE 16K BITS. A 2K-WORD BY 8-BIT (16KB) CHIP WHEN OPERATING WOULD CONSUME 276mW, WHICH IS COMPARABLE TO EQUIVALENT VOLATILE COMPLEMENTARY METAL OXIDE SEMICONDUCTOR (CMOS) RAMs AT LOWER SPEEDS. IN THIS STUDY, FEASIBILITY IS BEING DETERMINED THROUGH ANALYSIS AND DESIGN OF THE RAM AND IDENTIFICATION OF THE FABRICATION PROCESS. POTENTIAL COMMERCIAL APPLICATIONS EXIST FOR THE FAST NON-VOLATILE STATIC RAM IN THE REPLACEMENT OF THE VOLATILE RAM CURRENTLY USED IN ALL COMPUTERS AND ELECTRONIC GEARS. IT WOULD BE A SAFEGUARD AGAINST POWER FAILURE OR AS A MEANS TO ELIMINATE THE COSTLY BACK-UP POWER SUPPLY.

SILICON FILMS CORP
9410 DE SOTO AVE - UNIT H
CHATSWORTH, CA 91311
CONTRACT NUMBER:
S C MILLER

TITLE:

RUGATE STRUCTURES FOR SPACE BASED SURVIVABILITY
TOPIC# 8 OFFICE: IDENT#: 38703

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SURVIVABILITY OF SPACE-BASED PHOTOVOLTAIC ARRAYS AGAINST DIRECTED LASER BEAMS IS CRITICAL. HIGH INCIDENT ENERGY DENSITIES CAN CAUSE TEMPORARY OR PERMANENT DISRUPTION OF POWER GENERATING CAPABILITY. AS DEPOLYMENT AREAS INCREASE, THE POWER ARRAYS BECOME SUSCEPTIBLE TO DIRECTED GROUND AND SPACE-BASED THREAT. CURRENTLY, THERE IS NO VIABLE SOLUTION TO PROTECTING LARGE AREA PHOTOVOLTAIC SPACE ARRAYS FROM THIS THREAT. THE PROPOSED PHASE I PROGRAM WILL DEMONSTRATE LOW INSERTION LOSS OPTICAL FILTER STRUCTURES BASED UPON ACCURATE RUGATE PROFILES. THE STRUCTURES WILL BE DEPOSITED ONTO SOLAR CELL COVER GLASS AND DEVICE BASE MATERIAL FOR EVALUATION. THE RUGATE STRUCTURES WILL CONSIST OF NOVEL THIN FILM ALLOYS DEPOSITED BY A SCALABLE DEPOSITION PROCESS. IN ADDITION, THE THIN FILM MATERIALS EXHIBIT INTRINSIC HARDNESS TO HIGH ENERGY UV AND X-RAY RADIATION. SUCCESSFUL DEVELOPMENT WILL PROVIDE A SOLUTION TO THE CURRENT NEED, AND ALSO MAY BE EXTENDED TO OTHER APPLICATIONS WHICH REQUIRE ADVANCED OPTICAL COATINGS. THE DEMONSTRATED SCALABILITY OF THE PROCESS OFFERS THE POTENTIAL OF LOW UNIT COST AT PRODUCTION VOLUMES. OTHER APPLICATIONS INCLUDE LASER PROTECTIVE EYEWEAR, AIRCRAFT CANOPY COATINGS, AND VEHICLE WINDOW COATINGS.

SOURCE TEK INC
24 CARRIAGE HILL DR
POQUOSON, VA 23662
CONTRACT NUMBER:
DR SANG H CHOI
TITLE:
HIGH POWER INVERSE-PINCH PLASMA SWITCH
TOPIC# 5 OFFICE: IDENT#: 38710

AN INVERSE-PINCH SWITCH (INPIS) FOR DELIVERING OVER 1 MEGA-AMPERES AND 250 KV POWER IS BEING DEVELOPED IN THIS STUDY. THE INPIS EMPLOYS THE INVERSE-PINCH GEOMETRY WHICH ENABLES THE CURRENT SHEET TO SPREAD ON A WIDE AREA OF THE ELECTRODES INSTEAD OF FORMING A HOT SPOT AS IN A TYPICAL SPARK GAP. HENCE, THE CURRENT DENSITY IN THE INPIS IS REDUCED TO SEVERAL ORDERS OF MAGNITUDE BELOW THAT OF TYPICAL SPARK GAPS. THE INPIS HAS A VERY LOW INDUCTANCE, INTRINSIC TO ITS COAXIAL GEOMETRY WITH A SMALL ASPECT RATIO (INNER TO OUTER DIAMETERS) RESULTING IN A FAST RISE TIME. THE REQUIRED HOLD-OFF VOLTAGE (250

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kV) MAY BE ACHIEVED BY EMPLOYING MULTI-STAGED RING ELECTRODE (OR CALLED RIM-FIRE). IN THE DEVELOPMENT OF THE INPIS, THE MILESTONES EXPECTED TO BE ACHIEVED IN THIS RESEARCH, ARE THE VOLTAGE HOLD-OFF OF 250 kV; THE CURRENT CAPABILITY OVER 1 MA; THE RISETIME OF 100 ns; THE MEASUREMENT OF SWITCH PARAMETERS INCLUDING THE JITTER DELAY; EFFECTS ON THE PFL; AND, THE STUDY OF POWER SCALING OF INPIS. WHEN SUCCESSFUL, APPLICATIONS WOULD EXIST IN DIRECTED AND KINETIC ENERGY WEAPONS, CIF, AND PULSED POWER EQUIPMENT.

SPACE POWER INC
621 RIVER OAKS PKWY
SAN JOSE, CA 95134
CONTRACT NUMBER:
DANIEL COX
TITLE:
ALKALI-METAL VAPOR PRESSURE CONTROL
TOPIC# 4 OFFICE: IDENT#: 38714

A METHOD OF CONTROLLING AND MAINTAINING CESIUM VAPOR PRESSURE OF APPROXIMATELY 1 TO 2 TORR AT 900 TO 1000 K IS BEING INVESTIGATED. PREVIOUS EFFORTS HAVE ATTEMPTED TO CONTROL THE CESIUM PRESSURE IN THERMIONIC CONVERTER CELLS BY TEMPERATURE CONTROL IN SEPARATE LIQUID CESIUM RESERVOIRS OR BY VARYING CESIUM LOADING IN INTEGRAL RESERVOIRS CONSISTING OF INTERCALATED GRAPHITE. INTEGRAL RESERVOIRS ARE PREFERRED IN SPACE POWER SYSTEMS BECAUSE THEIR OPERATING TEMPERATURE CAN BE SET AT THE COLLECTOR TEMPERATURE, THUS SIMPLIFYING THE CORE CONFIGURATION. HOWEVER, THE INTERCALATED GRAPHITE RESERVOIR DESIGN HAS PRESENTED GRAPHITE SWELLING, POLLUTION OF THE EMITTER BY CARBON, AND INCONVENIENT CESIUM FILLING PROCEDURE. A NEW METHOD OF CESIUM VAPOR CONTROL IS PROPOSED IN THIS STUDY TO ELIMINATE ABOVE PROBLEMS. WHEN SUCCESSFUL, THIS APPROACH COULD BE USED AS AN INTEGRAL CESIUM RESERVOIR IN THERMIONIC CONVERTER CELLS FOR SPACE NUCLEAR REACTORS OR SOLAR POWER SYSTEMS. THE INTEGRAL CESIUM RESERVOIR WOULD GREATLY SIMPLIFY THE THERMIONIC FUEL ELEMENTS IN SPACE POWER SYSTEMS. THE COST WOULD BE REDUCED AND RELIABILITY COULD BE ENHANCED.

SPACE POWER INC
621 RIVER OAKS PKWY
SAN JOSE, CA 95134
CONTRACT NUMBER:
LESTER L BEGG
TITLE:
LOW MASS SURVIVABLE RADIATOR
TOPIC# 7 OFFICE: IDENT#: 38718

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HIGHLY SUCCESSFUL RADIATOR DESIGNS HAVE BEEN PRODUCED FOR LOW-MASS, RELIABLE TEN YEAR OPERATION. A SPECIFIC MASS VALUE OF 4.1 kg/m² WAS ACHIEVED FOR A HEAT PIPE RADIATOR SYSTEM DESIGNED TO OPERATE AT AN 875K DESIGN POINT. THIS HEAT PIPE RADIATOR SYSTEM WAS NOT SPECIFICALLY DESIGNED TO WITHSTAND HOSTILE THREATS. IT IS BY DESIGN, HOWEVER, INHERENTLY SURVIVABLE AGAINST X-RAY AND PELLET THREATS. IN THIS EFFORT, CHANGES ARE BEING MADE TO THE EXISTING RADIATOR DESIGN TO ENHANCE SURVIVABILITY AGAINST LASER THREATS. THIS EFFORT TAKES ADVANTAGE OF THE TECHNOLOGY AND DEVELOPMENT EFFORTS ALREADY EXPENDED AND ADDRESSES THE FEASIBILITY OF MAKING THE DESIGN SURVIVABLE AGAINST HOSTILE LASER THREATS.

SPACE POWER INC
621 RIVER OAKS PKWY
SAN JOSE, CA 95134

CONTRACT NUMBER:

JOSEPH R WETCH

TITLE:

RELIABLE REACTOR COOLING SYSTEM

TOPIC# 4

OFFICE:

IDENT#: 38719

THE HIGH COST AND RISK ASSOCIATED WITH PLACING LARGE SATELLITE INTO THE PROPER OPERATING ORBIT DICTATES THAT MAJOR SUBSYSTEMS BE EXTREMELY RELIABLE AND SURVIVABLE. THE AIR FORCE RECENTLY RECOMMENDED THAT SPACE POWER SUPPLIES BE DEVELOPED WITH NO SINGLE FAILURE POINT. A MEANS OF AVOIDING SINGLE POINT FAILURE IS BEING EMPLOYED IN SMALL SURVIVABLE NUCLEAR REACTORS CAPABLE OF 5 kWe TO 40 kWe OUTPUT SUCH AS THE SNAP-TOPAZ-DERIVATIVE REACTOR (STDR). THE STDR REACTOR SAFETY FEATURES LOW FUEL INVENTORY, LOW PROLIFERATION POTENTIAL AND INHERENT AVOIDANCE OF CRITICALITY AFTER MAJOR LAUNCH PAD FIRE OR AFTER REENTRY, DUE TO IRREVERSIBLE EXPULSION OF HYDROGEN MODERATOR ARE BEING RETAINED (REGARDLESS OF SAFETY OR CONTROL ROD POSITION). THE COOLING CONCEPT BEING INVESTIGATED UTILIZES UNIQUE WICK STRUCTURES AND REDUNDANT HEAT PIPE CONFIGURATIONS TO PASSIVELY REMOVE THE HEAT FROM A ²³⁸Pu-1.8 MODERATED INCORE THERMIONIC NUCLEAR SPACE POWER SYSTEM. THE ENTIRE PRIMARY COOLING SYSTEM OPERATES AT ABOUT 900 K AND IS CONSTRUCTED OF (SOTA) STAINLESS STEELS. THE KEY ELEMENTS OF THE COOLING SYSTEM ARE BEING DEMONSTRATED AND DEVELOPED.

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THIS STUDY IS UTILIZING THE EXISTING SNAP-TOPAZ-DERIVATIVE REACTOR (STDR) DESIGN BUT IS REPLACING THE PUMPED LOOP WITH HIGHLY REDUNDANT HEAT PIPE THERMAL TRANSPORT FROM THE REACTOR TO THE RADIATOR. WHEN INCORPORATED INTO A REACTOR, THE RESULTING POWER SYSTEM WOULD MEET THE PERFORMANCE, COST, RELIABILITY, SAFETY, NON-PROLIFERATION AND SURVIVABILITY REQUIREMENTS FOR SPACE POWER SYSTEMS IN THE RANGE OF 5 kWe TO 40 kWe. THE TECHNOLOGY, WHEN SUCCESSFULLY DEVELOPED, WOULD ALSO HAVE DIRECT APPLICATION TO RELIABLE COOLING OF COMPLICATED HIGH TEMPERATURE GEOMETRIES SUCH AS HYPERSONIC AIRCRAFT OR MISSILE LEADING EDGES, REENTRY BODIES, INDUSTRIAL PARTS AND SUBSYSTEMS EXPOSED TO HIGH TEMPERATURE PROCESS HEAT.

SPACE TECH CORP
125 CRESTRIDGE DR
FORT COLLINS, CO 80525
CONTRACT NUMBER:
DR MICHAEL ANDREWS

TITLE:
PARALLELIZED COMPUTATIONALLY EFFICIENT NUMERICAL ALGORITHMS FOR
SENSING DISCRIMINATION AND CONTROL
TOPIC# 10 OFFICE: IDENT#: 38724

AN EFFORT IS BEING UNDERTAKEN TO PARALLELIZE ALREADY EXTREMELY COMPUTATIONALLY EFFICIENT NUMERICAL ALGORITHMS THAT APPLY TO CLOSELY SPACED OBJECT RESOLUTION, SCAN TO SCAN, MATCHED FILTER, AND MATRIX INVERSION (SCD, LU, DECOMPOSITION, HOUSEHOLDERS) ALGORITHMS. THIS APPROACH DISTINCTIVELY MAPS ARCHITECTURES ONTO PARALLELIZED ALGORITHMS AND USES A MACHINE GRAPH THEORETIC MAPPING TECHNIQUE TO INSURE FAIL-SAFE IMPLEMENTATION. ESPECIALLY ATTRACTIVE FOR SPEED IMPROVEMENTS IS THE PHASE RETRIEVAL ALGORITHM IN INTERFEROMETRIC IMAGING. AN ELECTRO-OPTICAL IMPLEMENTATION IS BEING ASSUMED FOR A SYSTOLIC ARCHITECTURE, BOTH INHERENTLY HIGH BANDWIDTH TECHNOLOGIES. THE RESULTS WOULD HAVE DIRECT APPLICABILITY TO NETWORKED SENSORS AND DATA PROCESSORS FOR TARGET DETECTION AND KILL ESTIMATION. SUCCESSFUL RESULTS OF THIS STUDY WOULD ADD PROOF-OF-CONCEPT REALIZATION TO EFFICIENT ALGORITHM IMPLEMENTATION THAT IS ONLY POSSIBLE WHEN A COMBINED ALGORITHM/ARCHITECTURE ANALYSIS IS EXECUTED. CONSIDERABLY WIDE-SPREAD COMMERCIAL APPLICATIONS COULD BE FOUND IN MEDICAL IMAGING, ROBOTICS, INDUSTRIAL CONTROL AUTOMATION, AND

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DIGITAL SIGNAL PROCESSING. GREATLY REDUCED HARDWARE COSTS WOULD
RESULT, MAKING MEDICAL DIAGNOSIS MORE ECONOMIC.

SPACE TECH CORP
125 CRESTRIDGE DR
FORT COLLINS, CO 80525
CONTRACT NUMBER:
DR MICHAEL ANDREWS
TITLE:
EXPERIMENTAL RAPID ARCHITECTURAL PROTOTYPING
TOPIC# 10 OFFICE: IDENT#: 38725

A VERY LARGE SCALE INTEGRATED (VLSI) RAPID ARCHITECTURAL PROTOTYPE TOOL IS BEING INVESTIGATED WHICH DIFFERS SIGNIFICANTLY FROM EXISTING CAD TOOLS. MOST GENERIC COMPUTING ARCHITECTURES WILL REQUIRE A COMPILER TO BE BUILT (WHICH IS A SIGNIFICANT COST). THIS TOOL CONCEPT IS BOTH SOFTWARE AND HARDWARE DESIGN-DRIVEN. FOR THE FIRST TIME, IT WOULD ENABLE A VLSI ARCHITECT TO CONSIDER COMPILER ISSUES FOR THE RESULTANT ARCHITECTURE AS WELL AS TARGET HARDWARE PERFORMANCE PARAMETERS. ONE OUTPUT OF THE TOOL WOULD BE DESIGN GUIDANCE AND INSIGHT TOWARDS BETTER ARCHITECTURES. ANOTHER IS A KERNEL COMPILER WHICH WOULD REQUIRE RELATIVELY LITTLE ADDITIONAL FINE-TUNING FOR THE EVENTUAL TARGET MACHINE. THE KERNEL COULD GENERATE EXECUTABLE CODE SO THAT TRUE SIMULATION COULD PROVIDE ENGINEERING ESTIMATES ON ACTUAL APPLICATION SOURCE CODE PERFORMANCE. AN INVESTIGATION OF THE ENHANCING FEATURES OF AI TO THE EXPERT DESIGNER MODULES IS BEING UNDERTAKEN TO EXPEDITE THE HARDWARE DESIGN EFFORT. SPECIFICALLY, NOVEL INFERENCE ENGINES AND A KNOWLEDGE-BASE ARE BEING EMBEDDED WITHIN THE TOOL SET. THE INFERENCE ENGINES HOST THE RULE BASIS FOR SETTING UP THE FLOW ANALYZER IN THE COMPILER AND OPTIMIZING THE TARGET DESIGN ACCORDING TO USER-SPECIFIED DESIGN CRITERIA. BOTH DECLARATIVE AND META KNOWLEDGE ARE BEING INVOKED IN THE CODE GENERATOR WHICH CONSTITUTE THE TARGET ENVIRONMENT PARAMETERS SUCH AS SINGLE-INSTRUCTION/MULTI-DATA (SIMD), MULTI-INSTRUCTION/MULTI-DATA (MIMD), VECTOR, DATA-FLOW ORGANIZATION ETC. THE SUCCESSFUL OUTCOME OF THIS DEVELOPMENT WOULD APPLY DIRECTLY TO (ASIC) TOOL BUILDERS WHERE EXTENSIVE TIME-CONSUMING SIGNAL PROCESSING TASKS COULD BE SIGNIFICANTLY REDUCED. HIGHLY COMPLEX CIRCUITS WILL REQUIRE GREATER ARCHITECTURE DEGREES OF FREEDOM IN DESIGN.

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EMULATION, FIRMWARE ENGINEERING AND COMPILATION COULD BE FUNDAMENTALLY
LEVERAGED BY THE RESULTANT THEORETICS OF THIS STUDY SO THAT PROTOTYPE
EXPERIMENTAL SYSTEMS COULD BE COMPLETED.

SPARTA INC
23041 AVE DE LA CARLOTA - STE 400
LAGUNA HILLS, CA 92653
CONTRACT NUMBER:
DR JAMES MARR
TITLE:
DISTRIBUTED SYSTEMS SIMULATION PERFORMANCE IMPROVEMENT THROUGH
PARALLEL ALGORITHMS AND ARCHITECTURES
TOPIC# 10 OFFICE: IDENT#: 38858

THE OBJECTIVE OF THIS RESEARCH IS TO ACHIEVE HIGHER FIDELITY IN THE
SIMULATION OF THE SENSOR AND COMMUNICATIONS PORTIONS OF THE
STRATEGIC DEFENSE SYSTEM IN THE CONTEXT OF A REALTIME/HYPERTIME
BM/C3 SIMULATION TESTBED. THE ORIGINAL TRANSPUTER-BASED TESTBED WAS
A NETWORK OF 23 TRANSPUTERS. FOR THE TYPE OF NON-VECTOR ALGORITHMS
USED, THE NETWORK COMPUTATIONAL POWER IS COMPARABLE TO THAT OF A
CRAY. THE CURRENT RESEARCH IMPROVES THE INTER-PLATFORM
COMMUNICATIONS, SENSOR, AND COMM MODELS. OUR TECHNICAL APPROACH
DEPENDS ON THE POWER OF THE TRANSPUTER AND ON OUR ACCESS TO
KNOWLEDGE DEVELOPED ON MORE CONVENTIONAL TESTBEDS. THE ANTICIPATED
PAYOFF OF THE TRANSPUTER TESTBED PROGRAM IS A HIGH-FIDELITY
EMULATED OF THE SDI SYSTEM ALLOWING REALISTIC TESTING OF BM/C3
ALGORITHMS AND MESSAGE ROUTING ALGORITHMS AGAINST A REALISTIC THREAT.
APPLICATIONS OF THE EMULATION CAPABILITY TO NETWORKS, COMMERCIAL
MANUFACTURING, AND DISEASTER CONTROL PLANNING CAN BE EXPECTED TO
PROVIDE BENEFITS TO GOVERNMENT, INDUSTRY, AND THE COMMUNITY.

SPARTA INC (CA-DM)
1104 CAMINO DEL MAR
DEL MAR, CA 92014
CONTRACT NUMBER:
DR DANIEL L VRABLE
TITLE:
GRAPHITE/METAL-MATRIX COMPOSITE SPACE RADIATOR WITH INTEGRAL
THERMAL ENERGY STORAGE
TOPIC# 7 OFFICE: IDENT#: 38727

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THE HIGH POWER LEVELS FOR SPACE-BASED STATIONS WILL REQUIRE VERY LARGE THERMAL RADIATORS FOR THE REJECTION OF WASTE HEAT. SUBSTANTIAL TECHNOLOGY DEVELOPMENT WILL BE NECESSARY TO MOVE TO THE RANGE OF MULTI-MEGAWATT SYSTEMS. A KEY ELEMENT IN THE DEVELOPMENT OF RADIATOR DESIGNS IS IMPROVED THERMAL PERFORMANCE AND REDUCTION IN THE OVERALL RADIATOR SIZE AND WEIGHT. RECENT ADVANCEMENTS IN THE DEVELOPMENT OF ULTRA-HIGH THERMAL CONDUCTIVITY GRAPHITE FIBERS (690 BTU/hr-ft-F) IN METAL MATRIX COMPOSITES HAVE OPENED A NEW APPROACH FOR IMPROVING BOTH THE THERMAL PERFORMANCE AND REDUCING THE STRUCTURAL WEIGHT OF SPACE RADIATORS. IN ADDITION, THE ABILITY TO INTEGRATE A THERMAL ENERGY STORAGE MATERIAL WITHIN THE RADIATOR FIN COULD ALLOW THE HEAT REJECTION SYSTEM TO BE SIZED FOR THE AVERAGE RATHER THAN THE PEAK OF THE FLUCTUATING THERMAL LOAD. IN THIS STUDY, THE COMBINATION OF BOTH THE ULTRA-HIGH THERMAL CONDUCTIVITY GRAPHITE FIBERS IN A METAL MATRIX AND A HIGH CAPACITY MATERIAL (E.G. AN ORGANIC PHASE CHANGE MATERIAL WHOSE LATENT HEAT PROVIDES A LARGE EFFECTIVE HEAT CAPACITY NEAR ITS MELTING POINT) ARE BEING MERGED INTO RADIATOR CONCEPTUAL DESIGN. THIS CONCEPT IS EXPECTED TO PROVIDE A SUBSTANTIAL IMPROVEMENT IN THE THERMAL PERFORMANCE AND A REDUCTION IN RADIATOR SIZE AND WEIGHT OVER CURRENT DESIGNS. IN THIS PROGRAM, THE RADIATOR PERFORMANCE IS BEING EVALUATED; CONCEPTUAL DESIGN. THIS CONCEPT IS EXPECTED TO PROVIDE A SUBSTANTIAL IMPROVEMENT IN THE THERMAL PERFORMANCE AND A REDUCTION IN RADIATOR SIZE AND WEIGHT OVER CURRENT DESIGNS. IN THIS PROGRAM, THE RADIATOR PERFORMANCE IS BEING EVALUATED; CONCEPTUAL DESIGN IS BEING DEVELOPED; AND SUBSCALE FABRICATION IS BEING DEMONSTRATED. THE UTILIZATION OF ULTRA-HIGH THERMAL CONDUCTIVITY GRAPHITE FIBERS IN A METAL MATRIX AND THE ABILITY TO INTEGRATE THERMAL ENERGY STORAGE WOULD PROVIDE ENHANCED RADIATOR PERFORMANCE, SMALLER SIZE AND LOWER WEIGHT SYSTEMS FOR LARGE SPACE-BASED POWER CYCLES. WHEN SUCCESSFUL, THE CONCEPT WOULD BE DIRECTLY APPLICABLE TO A VARIETY OF MILITARY AND COMMERCIAL SPACE SYSTEMS.

SPARTA INC (MA)
21 WORTHEN RD
LEXINGTON, MA 02173
CONTRACT NUMBER:

ROBERT F DILLON

TITLE:

AGILE MULTIPLE APERTURE IMAGER RECEIVER

TOPIC# 3

OFFICE:

IDENT#: 38730

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A VARIETY OF UNCONVENTIONAL IMAGING SCHEMES HAVE BEEN INVESTIGATED IN RECENT YEARS THAT RELY ON SMALL, UNPHASED OPTICAL APERTURES (SUBAPERTURE) TO MEASURE PROPERTIES OF AN INCOMING OPTICAL WAVEFRONT AND RECOVER IMAGES OF DISTANT OBJECTS WITHOUT USING PRECISELY FIGURED, LARGE-APERTURE OPTICAL ELEMENTS. SUCH SCHEMES OFFER SEVERAL ATTRACTIVE FEATURES. THEY PROVIDE THE POTENTIAL TO CREATE VERY LARGE EFFECTIVE APERTURES THAT ARE EXPANDABLE OVER TIME AND CAN BE LAUNCHED INTO SPACE IN SMALL PIECES. SINCE THE SUBAPERTURES ARE IDENTICAL IN CONSTRUCTION, THEY MAY BE MASS PRODUCABLE AT POTENTIALLY LOW COST. A PLAN TO DEVELOP A LOW-COST, HIGH-SENSITIVITY, ELECTRONICALLY AGILE OPTICAL RECEIVER IS BEING INVESTIGATED FOR MULTIPLE APERTURE IMAGING SYSTEMS THAT MUST OPERATE OVER LONG RANGES. THIS PROGRAM WILL YIELD A PRELIMINARY RECEIVER DESIGN AND PROJECTED PERFORMANCE FIGURES FOR EVALUATING THE RISK AND COST ASSOCIATED WITH CONSTRUCTING A FULL-SIZED RECEIVER ARRAY. BASED ON A SUCCESSFUL DESIGN, A SINGLE SUBAPERTURE PROTOTYPE WILL BE CONSTRUCTED IN LATER RESEARCH AND ITS PERFORMANCE AND ULTIMATE PRODUCTION COST WILL BE VERIFIED. MULTIPLE APERTURE IMAGING MAY OFFER MANY ADVANTAGES WHEN USED TO IMAGE OVER LONG RANGES. THIS WORK HAS APPLICATION IN SPACE OBJECT SURVEILLANCE FOR GROUND TO SPACE AND GROUND RECONNAISSANCE. WHEN SUCCESSFUL, THIS WORK WOULD LEAD TO PRACTICAL, LOW-COST RECEIVERS WHICH FORM THE HEART OF THE SYSTEMS.

SPIRE CORP
PATRIOTS PARK
BEDFORD, MA 01730
CONTRACT NUMBER:
DR EDWARD A JOHNSON
TITLE:
ION IMPLANTED PLATINUM SILICIDE SUBSTRATES FOR RADIATION-HARD
MEDIUM-WAVELENGTH INFRARED FOCAL PLANE ARRAYS
TOPIC# 3 OFFICE: IDENT#: 38744

TRANSISTION METAL SILICIDE FILMS ON SILICON ARE FUNDAMENTALLY INTERESTING STRUCTURES FROM A CRYSTALLOGRAPHIC AND MATERIALS POINT OF VIEW. THEY ARE ALSO IMPORTANT BECAUSE OF THEIR APPLICATION AS SCHOTTKY BARRIER DIODE (SBD) INFRARED PHOTODETECTORS. RECENT WORK ON METAL SILICIDES FOR MICROELECTRONIC APPLICATIONS HAS SHOWN THAT

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HIGH QUALITY TRANSITION METAL SILICIDE/SILICON STRUCTURES CAN BE FORMED BY ION IMPLANTATION. IN THIS PROGRAM, THIS TECHNOLOGY IS BEING APPLIED TO FABRICATE PLATINUM SILICIDE FILMS FOR MEDIUM WAVELENGTH (MWIR) DETECTOR APPLICATIONS. THIS PROGRAM, WHEN SUCCESSFUL, WILL LEAD TO A BETTER UNDERSTANDING OF SILICIDE GRAIN GROWTH DURING IMPLANTATION, AND A BETTER UNDERSTANDING OF SCHOTTKY BARRIER DIODE DETECTOR PERFORMANCE, AS WELL AS A SUPERIOR PROCESS FOR PRODUCING SBD STRUCTURES.

SPIRE CORP
PATRIOTS PARK
BEDFORD, MA 01730
CONTRACT NUMBER:
STEVEN J WOJTCZUK
TITLE:
LONG WAVELENGTH INFRARED METALORGANIC CHEMICAL VAPOR DEPOSITION
GaAs/AlGaAs DETECTORS
TOPIC# 3 OFFICE: IDENT#: 38745

MANY LONG WAVELENGTH INFRARED (LWIR) PHOTODETECTORS USED IN FOCAL PLANE ARRAYS ARE HgCdTe-BASED, MAKING ARRAY INTEGRATION WITH RECEIVER FRONT-ENDS OR MULTIPLEXER CIRCUITS DIFFICULT. AlGaAs/GaAs LWIR (8-11 MICRON) QUANTUM WELL SUPERLATTICE DETECTORS PRESENT THE POSSIBILITY OF MONOLITHIC INTEGRATION OF LWIR DETECTOR ARRAYS WITH GaAs BASED MESFETS AND HEMTs. RUGGED FLIR FOCAL PLANE ARRAYS WITH SMALL SIZE, LOW NOISE, RADIATION HARDNESS, AND HIGH SPEED MAY RESULT FROM MONOLITHIC INTEGRATION. IN THIS STUDY, A METAL ORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) PROCESS IS BEING INVESTIGATED FOR EPITAXIAL GROWTH OF GaAs/AlGaAs SUPERLATTICES FOR LWIR PHOTODETECTORS, USING A BUFFER AND SUBSTRATE MATERIAL SUITABLE FOR MONOLITHIC INTEGRATION WITH GaAs METAL SEMICONDUCTOR FIELD-EFFECT TRANSISTOR (MESFETS). LAYER STRUCTURES ARE BEING TESTED FOR IR ABSORPTION, AND DETECTOR STRUCTURES SUITABLE FOR MONOLITHIC INTEGRATION WITH GaAs ICs ARE BEING GROWN. IN LATER RESEARCH, PHOTODETECTORS WILL BE FABRICATED AND THE EFFECTS OF TEMPERATURE, LAYER THICKNESS, AND COMPOSITION ON THE RESPONSITIVITY AND SPECTRAL RESPONSE WILL BE MEASURED AND SIMPLE MONOLITHIC RECEIVER FRONT-ENDS WILL BE MADE. WHEN SUCCESSFUL, MOCVD AlGaAs/GaAs SUPERLATTICE WAFERS COULD BE MARKETING TO COMPANIES INTERESTED IN MONOLITHIC INTEGRATION OF LWIR DETECTORS AND LOW NOISE,

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A/D CONVERTERS, SIS MIXERS, AND LOW NOISE AMPLIFIERS AT MICROWAVE
AND MILLIMETER WAVE FREQUENCIES.

SUPERCONDUCTOR TECHNOLOGIES INC
460 WARD DR - STE F
SANTA BARBARA, CA 93111
CONTRACT NUMBER:
DR ROBERT HAMMOND
TITLE:
SUPERCONDUCTING MILLIMETER WAVE MIXER
TOPIC# 15 OFFICE: IDENT#: 38765

THE FOCUS OF THIS PROGRAM IS TO FABRICATE A JOSEPHSON JUNCTION BY
EITHER AN INTENTIONALLY GROWN LATTICE-FAULT TECHNIQUE OR BY
FABRICATING A PROXIMITY-EFFECT JUNCTION FROM SUPERCONDUCTING FILMS
BASED ON THE THALLIUM SYSTEM. THESE JUNCTIONS WILL BE CHARACTERIZED
FOR NOISE, RF JOSEPHSON EFFECT, AND MIXING AT 61 GHz. USING THESE
TECHNIQUES, A HIGH QUALITY, REPRODUCIBLE MANUFACTURABLE MIXER DEVICE
CAN BE DEVELOPED. SUCH HIGH TEMPERATURE SUPERCONDUCTING MILLIMETER
WAVE JOSEPHSON DEVICES WILL FIND APPLICATION AS LOW NOISE VOLTAGE
CONTROLLED OSCILLATORS, PARAMETRIC AMPLIFIERS, AND AS ACTIVE ELEMENTS
IN SUPERCONDUCTING ANALOG TO DIGITAL CONVERTERS AT RATES UP TO 20
GIGASAMPLES PER SECOND.

SYNETICS CORP
540 EDGEWATER DR
WAKEFIELD, MA 01880
CONTRACT NUMBER:
B GRIFFITHS
TITLE:
NET INFORMATION APPROACH FOR DISTRIBUTED ESTIMATION ARCHITECTURE
TOPIC# 10 OFFICE: IDENT#: 38770

A DISTRIBUTED ESTIMATION ARCHITECTURE, TERMED NET INFORMATION
APPROACH, IS ADDRESSED IN THIS EFFORT. THIS ESTIMATION ARCHITECTURE
IS A MEANS WHEREBY OPTIMAL KALMAN FILTERING OPERATION COULD BE
DISTRIBUTED THROUGH THE NODES OF A DECENTRALIZED, HIERARCHIAL COMMAND

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AND CONTROL SYSTEM. USING THE NET INFORMATION APPROACH, LOCAL FILTERS RETAIN OPTIMALITY WITH RESPECT TO LOCAL SENSORS, AND NET INFORMATION GAINED IN ANY INTERVAL COULD BE EXCHANGED ASYNCHRONOUSLY TO GENERATE ESTIMATES THAT ARE GLOBALLY OPTIMAL. THIS EFFECT, WHEN DETERMINED FEASIBLE, WOULD FORM THE FOUNDATION FOR PROTOTYPE DISTRIBUTED ESTIMATION SOFTWARE, TO BE DEVELOPED IN A LATER EFFORT. WHEN SUCCESSFUL, THIS PROJECT WOULD RESULT IN IMPROVEMENTS OF LOCAL AUTONOMY, GLOBAL OPTIMALITY, AND ROBUSTNESS OF SYSTEM RESPONSE UNDER NETWORK DISRUPTION. THE NET INFORMATION APPROACH ALGORITHMS AND SOFTWARE COULD BE OF VALUE IN COMMERCIAL APPLICATIONS HAVING SIMILAR CONCERNS, SUCH AS THE CHEMICAL PROCESS INDUSTRY.

SYSTEMS & PROCESSES ENGINEERING CORP
1406 SMITH RD - STE A
AUSTIN, TX 78721
CONTRACT NUMBER:
GARY McMILLIAN
TITLE:
ARRAY COMMUNICATIONS COPROCESSOR
TOPIC# 10 OFFICE: IDENT#: 38775

AN ARRAY COMMUNICATIONS COPROCESSOR (ACC) ARCHITECTURE HAS BEEN DEVELOPED THAT PROVIDES AUTOMATIC, ADAPTIVE, AND DYNAMICALLY CONFIGURABLE INTER-PROCESSOR COMMUNICATIONS AND IS COMPATIBLE WITH MOST COMMERCIALY AVAILABLE STATE-OF-THE-ART COMPLEX INSTRUCTION SET COMPUTERS (CISC) AND REDUCED INSTRUCTION SET COMPUTERS (RISC). IN THIS INVESTIGATION, THE ARRAY COMMUNICATIONS CONTROLLER IS BEING IMPLEMENTED AS A COPROCESSOR SIMILAR TO A FLOATING POINT COPROCESSOR IMPLEMENTATION SO THAT INTER-PROCESSOR SYNCHRONIZED DATA TRANSFER COULD BE ACCOMPLISHED WITH A SINGLE IN-LINE INSTRUCTION. THIS METHODOLOGY WOULD GREATLY SIMPLIFY THE COMPLEXITY OF MULTI-PROCESSOR COMPUTER HARDWARE AND SOFTWARE. WHEN SUCCESSFUL, THIS INTER-PROCESSOR COMMUNICATIONS ARCHITECTURE WOULD PROVIDE AN AVENUE FOR DEVELOPMENT OF MULTI-PROCESSOR COMPUTERS FOR ADDRESSING LARGE SCALE STRATEGIC DEFENSE COMPUTING PROBLEMS, AND SIMPLER SOFTWARE FOR MULTI-PROCESSOR, REAL-TIME CONTROLLERS.

TACAN CORP
2111 PALOMAR AIRPORT RD
CARLSBAD, CA 92009
CONTRACT NUMBER:
DR MICHAEL M SALOUR
TITLE:
INTEGRATED THREE-TERMINAL OPTICAL SWITCHING IN HYBRID OPTOELECTRONIC STRUCTURES
TOPIC# 11 OFFICE: IDENT#: 38779

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RADIATION-HARD GaAs MESFET CIRCUITS. THIS TECHNOLOGY COULD BE AN ALTF NATIVE TO HYBRID TECHNOLOGIES USING HgCdTe DETECTORS WITH GaAs OR SILICON ICs. MONOLITHIC INTEGRATION COULD LEAD TO REDUCTIONS IN SIZE AND WEIGHT, ADVANTAGES OF GREAT IMPORTANCE FOR AEROSPACE APPLICATIONS.

SPIRE CORP
PATRIOTS PARK
BEDFORD, MA 01730
CONTRACT NUMBER:
DR FEREDDOON NAMAVAR
TITLE:

SILICON-ON-INSULATOR MATERIAL DEFECT REDUCTION BY GROWTH OF
GERMANIUM-DOPED EPITAXIAL SILICON
TOPIC# 14 OFFICE: IDENT#: 38748

CREATION OF BURIED INSULATING LAYERS IN SILICON WAFERS USING THE SEPARATION BY IMPLANTATION OF OXYGEN (SIMOX) PROCESS HAS GAINED SIGNIFICANT ATTENTION IN RECENT YEARS. SIMOX IS POSITIONED TO BE A PRIME CONTENDER IN THE SILICON-ON-INSULATOR (SOI) TECHNOLOGY PRIMARILY DUE TO ITS INHERENT RELIABILITY/REPRODUCIBILITY OF ION IMPLANTATION. ONE OBSTACLE TO ITS BROADER USE IS THE HIGH DENSITY OF DISLOCATIONS THAT APPEAR IN THE SILICON TOP LAYER FOLLOWING THE HIGH TEMPERATURE ANNEALING REQUIRED. THE DISLOCATIONS ARE LINEAR DEFECTS AND ARE PARTICULARLY HARMFUL IN THE FABRICATION OF BIPOLAR SIMOX DEVICES. PRIOR EXPERIMENTATION HAS SHOWN THAT IMPLANTATION OF GERMANIUM (Ge) IONS INTO THE SILICON OVERLAY OF SIMOX REDUCES THE THREADING DISLOCATION DEFECT DENSITY BY TWO TO THREE ORDERS OF MAGNITUDE. IMPLANTATION OF Ge CREATES AN AMORPHIZED AND STRAINED LAYER WHICH ACTS AS AN ARTIFICIAL INTERFACE AND DEFLECTS THREADING DISLOCATIONS. IN THIS PROJECT, A VERY THIN (1000 TO 2000 ANGSTROM) STAINED LAYER IS CREATED BY EPITAXIAL REGROWTH OF Ge-DOPED Si ON THE Si OVERLAYER OF SIMOX. IF SUCCESSFUL, THIS WILL PROVIDE AN EASY AND ECONOMICAL METHOD OF REDUCING THE DENSITY OF DEFECTS AND COULD BE USED TO INCREASE THE QUALITY OF OTHER SOI MATERIALS. GOOD QUALITY SIMOX WAFERS COULD BE CRUCIAL TO DEVELOPMENT OF THE TECHNOLOGY FOR COMMERCIAL APPLICATION IN SUBMICRON AND THREE DIMENSIONAL ARCHITECTURE DEVICES.

SUPERCONDUCTOR TECHNOLOGIES INC
460 WARD DR - STE F
SANTA BARBARA, CA 93111
CONTRACT NUMBER:
DR McDONALD ROBINSON
TITLE:

CHEMICAL VAPOR DEPOSITION OF EPITAXIAL THALLIUM-BASED
SUPERCONDUCTING FILMS
TOPIC# 15 OFFICE: IDENT#: 38761

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THE OBJECTIVE OF THIS PROJECT IS TO DEVELOP A CHEMICAL VAPOR DEPOSITION (CVD) PROCESS TO GROW THIN FILMS OF THALLIUM-BASED SUPERCONDUCTING OXIDES EPITAXIALLY ONTO SINGLE CRYSTAL SUBSTRATES. THE GOAL IS TO DEVELOP A MANUFACTURING PROCESS FOR HIGH QUALITY SINGLE CRYSTAL FILMS OF $Tl_2Ba_2Ca(n-1)Cu(n)O(4+2n)$ ($n=2,3$), THE FAMILY OF SUPERCONDUCTORS HAVING THE HIGHEST KNOWN CRITICAL TEMPERATURE. A SUCCESSFUL PROCESS DEVELOPMENT CAN PAVE THE WAY FOR THE MILITARY AND COMMERCIAL APPLICATIONS OF HIGH TEMPERATURE SUPERCONDUCTORS. A PROCESS USING LOWER GROWTH TEMPERATURES THAN PRESENT ALSO OPENS THE POSSIBILITY OF COMBINING SUPERCONDUCTORS WITH SEMICONDUCTORS IN A MONOLITHIC STRUCTURE, WITH APPLICATIONS IN MILITARY AND COMMERCIAL COMMUNICATIONS AND COMPUTERS.

SUPERCONDUCTOR TECHNOLOGIES INC

460 WARD DR - STE F

SANTA BARBARA, CA 93111

CONTRACT NUMBER:

DR WILLIAM OLSON

TITLE:

JUNCTION ARRAYS IN HIGH TEMPERATURE OXIDE SUPERCONDUCTORS

TOPIC# 15

OFFICE:

IDENT#: 38764

THIS PROJECT INVESTIGATES AN APPROACH FOR CREATING PERIODIC ARRAYS OF SUPERCONDUCTOR-INSULATOR-SUPERCONDUCTOR (SIS)-LIKE JUNCTIONS WITHIN A THIN HIGH T_c SUPERCONDUCTING STRIP LINE ON A DIELECTRIC SUBSTRATE. THE ARRAY IS EXPECTED TO DISPLAY DC AND AC JOSEPHSON CHARACTERISTICS THAT COULD BE USED AS JUNCTION DEVICES IN MANY APPLICATIONS. THE TECHNOLOGY FOR CREATING THIS JUNCTION ARRAY IS BASED ON RESEARCH WHICH SHOWS THAT IT IS POSSIBLE TO INDUCE PERIODIC, PARALLEL ARRAYS OF MICROCRACKS WITHIN A BRITTLE FILM IN A PREDICTABLE AND CONTROLLED MANNER. SUCH MICROCRACKS ARE EXPECTED TO EXHIBIT SIS-LIKE JUNCTION CHARACTERISTICS, AS PREVIOUSLY EVIDENT FROM BREAK JUNCTION DEMONSTRATIONS OF HTSC MATERIALS. GOLD BRIDGES WILL BE DEPOSITED AMONG INSULATING MICROCRACK JUNCTIONS WITHIN THE FILMS TO FORM SNS-LIKE JUNCTIONS. SUCCESSFUL DEMONSTRATION OF THIS BREAK ARRAY JUNCTION WILL PROVIDE THE BASIC FOR FOLLOW-ON DEVELOPMENT IN WHICH THE JUNCTION SPACING AND CHARACTERISTICS ARE IMPROVED. POTENTIAL APPLICATIONS OF THESE JUNCTION ARRAY INCLUDE: HIGH SPEED

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THIS STUDY INVESTIGATES THE USE OF OPTICAL SWITCHING IN HYBRID OPTOELECTRONIC STRUCTURES. THE PROGRAM APPROACH IS TO ANALYZE THE PERFORMANCE OF A HIGH-SPEED OPTICAL SWITCH THAT ALLOWS A SMALL OPTICAL SIGNAL TO CONTROL THE TRANSMISSION OF ANOTHER, LARGER OPTICAL SIGNAL. THIS SWITCH GIVES INPUT-OUTPUT ISOLATION, GAIN, AND A LARGE NUMBER OF FAN-OUTS WHILE ALLOWING MAXIMUM SWITCHING RATES OF 10 GHz WITH VERY LOW SWITCHING ENERGIES (1 FEMTO-JOULE). IN THIS PROGRAM, THE FEASIBILITY OF LARGE SCALE INTEGRATION OF THESE STRUCTURES ONTO TWO-DIMENSIONAL SUBSTRATES IS BEING DETERMINED. SUCCESSFUL DEMONSTRATION OF THIS DEVICE PROVIDES A SUPPORTING TECHNOLOGY FOR HIGH-SPEED LOGIC GATES, SPATIAL LIGHT MODULATORS, OPTICAL MEMORIES, OPTICAL DIGITAL COMPUTERS, AND OPTICAL NEURAL NETWORKS.

TALANDIC RESEARCH CORP
2793 E FOOTHILL BLVD
PASADENA, CA 91107
CONTRACT NUMBER:
DR CHRISTINE CARMICHAEL
TITLE:

HIGH TEMPERATURE SUPERCONDUCTORS WITH SEMICONDUCTORS AND INSULATORS FOR SUPERCONDUCTING SUPERLATTICES

TOPIC# 15 OFFICE: IDENT#: 38782

THIS PROJECT USES ELECTRON BEAM EVAPORATION TO PRODUCE DEPOSITS OF THIN FILMS OF HIGH TEMPERATURE SUPERCONDUCTORS, INTERLEAVING VERY THIN LAYERS OF SEMICONDUCTING AND INSULATING MATERIALS. THE RESULTANT SUPERCONDUCTOR SUPERLATTICES ARE THEN INVESTIGATED BY X-RAY DIFFRACTION AND ELECTRON MICROSCOPE TO DETERMINE OPTIMUM PRODUCTION PROCESSES. IF SUCCESSFUL, THE ELECTRON BEAM EVAPORATION PROCESS MIGHT PERMIT MANUFACTURE OF JOSEPHSON JUNCTION DEVICES AND INTEGRATED CIRCUITS WITH MANY APPLICATIONS IN THE MILITARY AND COMMERCIAL SECTORS.

TECHNICAL RESEARCH ASSOCS
410 CHIPETA WY - STE 222
SALT LAKE CITY, UT 84108
CONTRACT NUMBER:
JOSEPH K WEEKS

TITLE:
GRAPHITE REINFORCED ALUMINUM COMPOSITE BY LIQUID METAL INFILTRATION
TOPIC# 13 OFFICE: IDENT#: 38784

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HIGH MODULUS GRAPHITE FIBERS AS REINFORCEMENTS FOR ALUMINUM ALLOYS HAVE BEEN AVOIDED BECAUSE OF THE INTERACTION BETWEEN THE FIBERS AND THE ALUMINUM MATRIX. IN THIS STUDY A FIBER COATING SYSTEM IS BEING INVESTIGATED TO PREVENT THE INTERACTION OF THE GRAPHITE FIBERS WITH THE ALUMINUM ALLOY. WETTING EXPERIMENTS ARE BEING PERFORMED TO DETERMINE WHICH COATING MATERIALS ARE MOST EASILY WET BY THE MOLTEN ALUMINUM. FIBERS ARE BEING COATED AND INFILTRATED WITH THE ALUMINUM UNDER VACUUM. PHYSICAL PROPERTIES OF THE RESULTANT COMPOSITES ARE BEING EVALUATED TO DETERMINE HOW EFFECTIVE THE COATING SYSTEM IS IN PROTECTING THE FIBERS. THE ALUMINUM-GRAPHITE COMPOSITES, WHEN SUCCESSFULLY DEVELOPED, ARE EXPECTED TO HAVE EXCELLENT HIGH TEMPERATURE RESISTANCE, STIFFNESS, AND THERMAL CONDUCTIVITY. THESE COMPOSITES WOULD BE EXTREMELY USEFUL AS STRUCTURAL COMPONENTS IN AEROSPACE APPLICATIONS.

TETRA CORP
4905 HAWKINS NE
ALBUQUERQUE, NM 87109
CONTRACT NUMBER:
WILLIAM M MOENY
TITLE:
MEGAVOLT MEGAHERTZ PULSE GENERATOR TECHNOLOGY
TOPIC# 5 OFFICE: IDENT#: 38795

A HIGH VOLTAGE PULSE GENERATOR TECHNOLOGY IS BEING DEVELOPED FOR PRACTICAL BEAM ACCELERATORS, PULSED X-RAY SOURCES AND OTHER PULSE POWER APPLICATIONS. THE SPECIFIC TECHNOLOGY CAPABILITY IS SHORT PULSE WIDTH (10-250 nsec), HIGH VOLTAGE PULSE (1 MV AND ABOVE) DELIVERED AT A HIGH REPETITION RATE (1 MHz AND ABOVE). IN THIS PROGRAM THE TECHNOLOGY PERFORMANCE IS BEING INVESTIGATED AND A SMALL SCALE PROOF OF PRINCIPLE PULSE GENERATOR IS BEING BUILT AND TESTED TO DETERMINE THE FEASIBILITY OF THE CONCEPT. THIS PROGRAM WILL LAY THE GROUNDWORK FOR DEVELOPING AND TESTING A HIGH VOLTAGE (250-1,000 kV) REPETITIVE (1-10 MHz) PULSE GENERATOR IN A LATER EFFORT. THE TECHNOLOGY, WHEN SUCCESSFUL, WOULD RESULT IN A NEW GENERATION OF HIGH VOLTAGE REPETITIVE PULSE GENERATORS, INCLUDING PULSE GENERATORS FOR COMMERCIAL LASER SYSTEMS AND MEDICAL ACCELERATORS.

TETRA CORP
4905 HAWKINS NE
ALBUQUERQUE, NM 87109
CONTRACT NUMBER:
DR JUAN M ELIZONDO
TITLE:
PLASMA CATHODE FOR HIGH POWER PHOTOIONIZED LASERS AND PLASMA SWITCHES
TOPIC# 1 OFFICE: IDENT#: 38797

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EFFICIENCY OF HIGH POWER UV-PHOTOIONIZED EXCIMER AND CO2 LASERS HAVE BEEN LIMITED BY THE POWER CONSUMED IN THE PHOTOIONIZED SOURCE. THE USE OF SCREEN CATHODES PRESENTS THE PROBLEM OF MECHANICAL STRENGTH. SCREEN CATHODES MADE OUT OF WIRE MESH ARE EXCELLENT LIGHT TRANSMITTERS BUT LACK MECHANICAL STRENGTH, NOT TO MENTION THAT THEY CAN BE DESTROYED BY ARCING. CATHODES MADE OUT OF PERFORATED ALUMINUM OR STAINLESS STEEL ARE MECHANICALLY SOUND, BUT LIGHT TRANSMISSION IS NO BETTER THAN 60%. IF THE WORK BEING PERFORMED IS SUCCESSFUL, THE USE OF SCREENS IN BETWEEN THE PHOTOIONIZATION SOURCE AND THE MAIN DISCHARGE WOULD BE ELIMINATED BY INTEGRATING THE PHOTOIONIZATION SOURCE TO THE CATHODE SURFACE. A SECOND MORE IMPORTANT TECHNOLOGY BREAKTHROUGH IS THE ABILITY OF THIS CONCEPT TO WORK AT VERY HIGH FREQUENCIES, FROM A FEW KILOHERTZ UP TO HUNDREDS OF MEGAHERTZ. THESE HIGH REPETITION RATES ARE POSSIBLE DUE TO THE EXTREMELY LOW INDUCTANCE OF THE CONCEPT AND THE WAY THE COUPLING WITH THE DRIVING CIRCUIT COULD BE CHANGED FROM CAPACITIVE TO RESISTIVE OR A TUNED COMBINATION. DEVELOPMENT OF THIS TECHNOLOGY IN THE LARGE SURFACE, HIGH CURRENT DENSITY REGIMENS WOULD REPRESENT A MAJOR BREAKTHROUGH IN CATHODE TECHNOLOGY. SOME OF THE ADVANTAGES, IMPLICIT TO THE DESIGN, ARE THE CURRENT AND VOLTAGE GAIN. SUCCESSFUL DEVELOPMENT OF THE PLASMA-CATHODE WOULD RESULT IN MORE COMPACT AND MECHANICALLY SOUND PHOTOIONIZED EXCIMER AND PLASMA SWITCHES, AS WELL AS AT LEAST A 40% ENHANCEMENT IN THE UV USAGE FROM THE THE PHOTOIONIZATION SOURCE.

THERMACORE INC
780 EDEN RD
LANCASTER, PA 17601
CONTRACT NUMBER:
JOHN H ROSENFELD
TITLE:
LOW-MASS INTRINSICALLY-HARD HIGH TEMPERATURE RADIATOR
TOPIC# 7 OFFICE: IDENT#: 38800

STRATEGIC DEFENSE REQUIREMENTS FOR HIGH-TEMPERATURE WASTE HEAT REJECTION INCLUDE A NEED FOR HARDENED, LIGHTWEIGHT RADIATOR EQUIPMENT TO OPERATE NEAR 875 DEGREES KELVIN. CURRENT DESIGNS UNDER CONSIDERATION PLANS TO USE MATERIALS SUCH AS TITANIUM COMPOSITE AS

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THE HEAT PIPE RADIATOR WALL MATERIAL. THIS MATERIAL IS POTENTIALLY DIFFICULT TO FABRICATE IN A THIN-WALLED VACUUM-TIGHT VESSEL. IT IS ALSO RELATIVELY VULNERABLE TO THREATS COMPARED TO REFRACTORY METAL DESIGNS DUE TO ITS RELATIVELY LOW-MELTING POINT. A NEW NIOBIUM COMPOSITE MATERIAL IS BEING DEVELOPED IN THIS STUDY AS AN ALTERNATIVE TO TITANIUM COMPOSITES. THIS MATERIALS SHOWS PROMISE FOR SURVIVABILITY, WELDABILITY, NEUTRON ABSORBTIVITY, DEBRIS AND MICROMETEOROID RESISTANCE, AND 3 TO 5 KG/M2 RADIATOR MASS WHILE SERVING AS A WALL MATERIAL FOR HIGH TEMPERATURE RADIATOR COMPONENTS. IN THIS PROGRAM, THE FEASIBILITY OF ADVANCED REFRACTORY COMPOSITES AS A HARDENED RADIATOR WALL MATERIAL IS BEING INVESTIGATED. REQUIREMENTS ARE BEING DEFINED AND USED AS A BASIS FOR A COMPLETE 875 DEGREE KELVIN HEAT REJECTION SYSTEM DESIGN. IMPROVED RESISTANCE TO THREATS ARE BEING DEMONSTRATED BY ANALYSIS. A VACUUM TIGHT LIQUID METAL HEAT PIPE IS BEING FABRICATED USING A NIOBIUM COMPOSITE MATERIAL. HYPERVELOCITY PARTICLE BUMPERING CAPABILITY IS BEING DEMONSTRATED BY EXPERIMENT. SUCCESSFUL DEVELOPMENT OF THIS MATERIAL INTO A HEAT PIPE RADIATOR WOULD PROVIDE STATE-OF-THE-ART LIGHTWEIGHT HIGH TEMPERATURE RADIATORS. THIS MATERIAL WOULD ALSO BE AN IMPORTANT AEROSPACE MATERIAL ALTERNATIVE FOR APPLICATIONS. IT WOULD ALSO REPRESENT A SIGNIFICANT ADVANCE IN REDUCTION OF WALL THICKNESS FOR VACUUM-TIGHT ENVELOPES TO BE OPERATED AT 1000 DEGREES CELSIUS AND ABOVE.

THERMACORE INC
780 EDEN RD
LANCASTER, PA 17601

CONTRACT NUMBER:

JOHN H ROSENFELD

TITLE:

SORPTION RESERVOIRS FOR THERMIONIC CONVERTERS

TOPIC# 4

OFFICE:

IDENT#: 38803

THERMIONIC ENERGY CONVERTERS, AS THEY NOW EXIST, ARE THREE-TEMPERATURE DEVICES: INPUT (EMITTER), OUTPUT (COLLECTOR) AND CESIUM RESERVOIR. THE RESERVOIR REQUIRES PRECISE CONTROL AT A TEMPERATURE ON THE ORDER OF 600K. A SEPARATE RESERVOIR IS REQUIRED FOR EACH CONVERTER OR THERMIONIC FUEL ELEMENT. THE COMPLEXITY ARISING FROM THE RESERVOIR CONTROL PROBLEM IS SUFFICIENT TO DISQUALIFY THERMIONIC

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SYSTEMS IN SOME INSTANCES. IN THIS PROGRAM, AN INTERNAL SELF-CONTROLLING CESIUM RESERVOIR IS BEING DEVELOPED, MAKING THE THERMIONIC CONVERTER A TRUE TWO-TEMPERATURE DEVICE. PREVIOUS WORK HAS IDENTIFIED AT LEAST TWO TYPES OF RESERVOIRS USING SORPTION PRINCIPLES. EACH HAS LIFE LIMITING FAILURE MECHANISMS. THIS TECHNICAL APPROACH IS EXPECTED TO ELIMINATE THESE FAILURE MECHANISMS, YIELDING A RELIABLE, LONG-LIVED CONVERTER. WHEN SUCCESSFUL, THE USE OF THERMIONIC CONVERSION WOULD BE GREATLY SIMPLIFIED. THIS SIMPLIFICATION IS EXPECTED TO MAKE THERMIONIC CONVERSION PRACTICAL FOR USE IN SPACE POWER PLANTS AND POTENTIALLY FOR LUNAR AND PLANETARY BASES.

THERMACORE INC
780 EDEN RD
LANCASTER, PA 17601

CONTRACT NUMBER:

JOHN H ROSENFELD

TITLE:

SPACE DESIGNED 10KW THERMAL DIODE HEAT PUMP HEAT REJECTION SYSTEM

TOPIC# 7

OFFICE:

IDENT#: 38804

THIS RESEARCH EFFORT INTENDS TO DEVELOP AND DEMONSTRATE A SPACE DESIGNED RANKINE HEAT PUMP HEAT REJECTION SYSTEM. THE DESIGN AND DEMONSTRATION OF THE FOLLOWING CRITICAL COMPONENTS ARE BEING INVESTIGATED: LOW PRESSURE DROP; LOW TEMPERATURE DROP; HIGH HEAT FLUX (100 W/cm²) COLD PLATES; LOW PRESSURE DROP; SPACE OPERABLE CONDENSER WITH INTEGRAL HEAT EXCHANGER TO A 10 KW THERMAL DIODE, HARDENED HEAT PIPE HEAT REJECTION RADIATOR. ANTICIPATED APPLICATIONS ARE HIGH HEAT FLUX COLD PLATES, LOW PRESSURE DROP, LOW TEMPERATURE DROP CONDENSER, AND LOW MASS RADIATORS IN COMMUNICATION SATELLITES. ALSO, THE HIGH HEAT FLUX COLD PLATES HAS ENORMOUS POTENTIAL IN THE COOLING OF ELECTRONIC WARFARE, LASER DIODES, AND, IF THEY CAN BE DEMONSTRATED AT CRYOGENIC TEMPERATURES, THE COOLING OF LINACS FOR NEUTRAL PARTICLE BEAMS.

TRACER TECHNOLOGIES INC
20 ASSEMBLY SQUARE DR
SOMERVILLE, MA 02145

CONTRACT NUMBER:

FRASER WALSH

TITLE:

HIGH T_c SUPERCONDUCTIVE WIRE

TOPIC# 15

OFFICE:

IDENT#: 38813

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THE OBJECTIVE OF THIS PROGRAM IS TO PREPARE USEFUL LENGTHS OF A HIGH TEMPERATURE SUPERCONDUCTING WIRE AND TO DEMONSTRATE THAT THE WIRE IS A PHYSICALLY STABLE SUPERCONDUCTOR WITH HIGH CURRENT CARRYING CAPABILITY, SUITABLE FOR POWER TRANSMISSION, CONDITIONING, AND STORAGE SYSTEMS. THE WIRE IS BEING CHARACTERIZED FOR: RESISTIVITY, AS A FUNCTION OF TEMPERATURE AND CURRENT DENSITY; PHYSICAL STABILITY; RESPONSE IN AN RLC RESONANT CIRCUIT; MEISSNER EFFECT; AND THE EFFECT AN APPLIED MAGNETIC FIELD HAS ON CRITICAL CURRENT DENSITY. THE GROSS PHYSICAL CHARACTERISTICS OF THE WIRE ARE BEING DETERMINED BY A SCANNING ELECTRON MICROSCOPE. AUGER PROFILE ANALYSIS IS USED TO DETERMINE THE WIRE CHEMISTRY. THE EFFECTS OF MOISTURE, REPEATED TEMPERATURE CYCLES, AND REOXIDATION ARE ALSO BEING EVALUATED. THE MANUFACTURING PROCESS, IF SUCCESSFUL, WILL HAVE IMMEDIATE APPLICATION IN PROVIDING COMMERCIAL SUPERCONDUCTING WIRE FOR THE FABRICATION OF ADVANCED HIGH-FIELD MAGNETS AND SOLENOIDS, ELECTRIC MOTOR WINDINGS, SUPERCONDUCTING ROTORS IN ELECTRIC POWER GENERATORS, TRANSFORMERS, INDUCTION ENERGY STORAGE SYSTEMS, AND SQUIDS.

U.S. AUTOMATION CO

2727 SECOND AVE

DETROIT, MI 48201

CONTRACT NUMBER:

DANIEL J BORODIN

TITLE:

HIGH TEMPERATURE SUPERCONDUCTOR PRODUCTION USING EXTERNALLY INDUCED SHEAR DURING RECRYSTALLINE CYCLE

TOPIC# 15

OFFICE:

IDENT#: 38826

THE OBJECTIVE OF THIS PROJECT IS TO ESTABLISH CONTROL CONDITIONS TO STIMULATE THE FORMATION OF DESIRED SUPERCONDUCTIVE CRYSTALLINE STRUCTURES. THE ADDED CONTROL USED IS AN EXTRENNALLY INDUCED SHEAR ON THE HIGH TEMPERATURE SUPERCONDUCTING (HT-SC) MATERIAL DURING ITS RECRYSTALLIZATION KINETIC CYCLE. THE THEREMATRESS COMMON TO FERROUS, NON-FERROUS, AND CERAMIC SYSTEMS. THE PROCESS IS EXPECTED TO PRODUCE AN IMPROVEMENT IN THE WELL KNOWN HT-SC MATERIAL, YTTRIUM-BARRIUM-COPPER-OXYGEN, WHEN IT IS SUBJECTED TO THE EXTERNALLY INDUCED CONTROL SHEAR DURING RECRYSTALLIZATION. RESULTS ARE BEING DOCUMENTED BY CHARACTERIZATION OF RANDOMLY CHOSD SILICED OF FINISHED PROCESSED

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SPECIMENT. IF SUCCESSFUL, THIS PROCESS WOULD IMPROVE THE CONSISTENCY AND RELIABILITY OF WIRE SUPERCONDUCTORS, AND LEAD TO A FABRICATION TECHNIQUE PERMITTING MANUFACTURE OF HIGH TEMPERATURE SUPERCONDUCTORS ON A CONTINUOUS, ECONOMICAL, COMMERCIAL PRODUCTION BASIS.

ULTRAMET

12173 MONTAGUE ST

PACOIMA, CA 91331

CONTRACT NUMBER:

DR JOHN T HARDING

TITLE:

CHEMICAL VAPOR DEPOSITION PLATINUM COATINGS FOR INCREASED CHEMICAL
ROCKET EFFICIENCY

TOPIC# 6

OFFICE:

IDENT#: 38820

EXTRAORDINARY INCREASES IN ROCKET COMBUSTION CHAMBER OPERATING TEMPERATURE HAVE BEEN ACHIEVED WITH IRIIDIUM-COATED RHENIUM ROCKET THRUSTERS. THIS HAS RESULTED IN A GREATER THAN 20-SECOND IMPROVEMENT IN SPECIFIC IMPULSE WITH NO SACRIFICE IN LIFETIME. THREE OF THE PLATINUM GROUP METALS, PLATINUM, RHODIUM, AND IRIIDIUM, HAVE THE CAPABILITY TO PROTECT REFRACTORY STRUCTURAL MATERIALS FROM OXIDATION AT TEMPERATURES SUBSTANTIALLY HIGHER THAN ACHIEVABLE WITH STATE-OF-THE-ART (SILICIDE) COATINGS. BESIDES HAVING HIGH MELTING POINTS, THESE METALS ARE HIGHLY OXIDATION-RESISTANT. IRIIDIUM HAS BEEN DEPOSITED BY CHEMICAL VAPOR DEPOSITION (CVD) AND HAS DEMONSTRATED ITS USEFULNESS FOR LONG-TERM PROTECTION OF RHENIUM THRUST CHAMBERS UNDER OXIDIZING CONDITIONS AT 2200 DEGREES CELSIUS. IRIIDIUM HAS TWO DRAWBACKS HOWEVER: ITS RELATIVE SCARCITY AND HIGHER OXIDATION RATE COMPARED TO THOSE OF PLATINUM AND RHODIUM. THE MELTING POINT OF PLATINUM, 1770 DEGREES CELSIUS, IS LOWER THAN THAT OF IRIIDIUM, BUT IS STILL AMPLE FOR NIOBIUM ALLOYS AND IS SUBSTANTIALLY HIGHER THAN THE 1400 DEGREES CELSIUS LIMIT FOR SILICIDE-BASED COATINGS. PLATINUM IS ALMOST 100 TIMES AS ABUNDANT AS IRIIDIUM IN RECOVERABLE MINERAL DEPOSITS, AND IS MORE GLOBAL WIDESPREAD. NO SATISFACTORY TECHNIQUE CURRENTLY EXISTS FOR FORMING ADHERENT, NON-POROUS DEPOSITS OF PLATINUM ON COMPLEX SHAPES SUCH AS THRUST CHAMBERS. IN THIS PROGRAM, THE FEASIBILITY OF CVD FOR FORMING THICK, ADHERENT NON-POROUS DEPOSITS OF PLATINUM ON COMPLEX SHAPES SUCH AS THRUST CHAMBERS. IN THIS PROGRAM, THE FEASIBILITY OF CVD FOR FORMING THICK, ADHERENT

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NON-POROUS COATINGS OF PLATINUM ON THRUSTERS IS BEING INVESTIGATED. COATING THE COMBUSTION CHAMBER AND THROAT OF A THRUSTER WITH PLATINUM IS EXPECTED TO PERMIT SIGNIFICANTLY HIGHER COMBUSTION TEMPERATURES, RESULTING IN HIGHER SPECIFIC IMPULSE....THE SUCCESSFUL DEVELOPMENT OF AN ALTERNATIVE TO IRIIDIUM FOR HIGH TEMPERATURE OXIDATION PROTECTION WOULD RELIEVE THE DEMAND ON THIS RELATIVELY SCARCE METAL AND ALLOW IT TO BE USED WHERE IT IS MOST NEEDED.

UNIVERSAL ENERGY SYSTEMS INC

4401 DAYTON-XENIA RD

DAYTON, OH 45432

CONTRACT NUMBER:

RABI BHATTACHARYA

TITLE:

SELF-LUBRICATING SURFACES BY ION-BEAM PROCESSING

TOPIC# 13 OFFICE: IDENT#: 38824

HIGH TEMPERATURE SOLID LUBRICATION IS OF INTEREST TO TODAY'S GAS TURBINE ENGINE TECHNOLOGY. AS AN EXAMPLE, THE VARIABLE STATOR VANE BUSINGS AND THRUST REVERSAL BEARINGS IN GAS TURBINE ENGINES REQUIRE HIGH TEMPERATURE SELF-LUBRICATING HARD COATINGS. CURRENTLY, THE COMMON WAYS OF LAYING DOWN SUCH SELF-LUBRICATING SURFACES ARE: PLASMA SPRAY, VACUUM DEPOSITION, AND THERMAL DEPOSITION. THE COATINGS SO DEVELOPED ARE GENERALLY POROUS AND DO NOT ADHERE WELL TO THE SUBSTRATE. IN THIS INVESTIGATION, SELF-LUBRICATING COATINGS ARE BEING DEVELOPED THROUGH A COMBINED PROCESS OF ELECTRON BEAM EVAPORATION AND ION IMPLANTATION. A COMPOSITE ($\text{BaF}_2/\text{CaF}_2/\text{Ag}$) IS BEING SYNTHESIZED IN THE NEAR SURFACE REGION OF A NICKEL BASED SUPERALLOY THROUGH ION IMPLANTATION OR ION-BEAM MIXING. THE COATINGS ARE BEING ANALYZED FOR COMPOSITION, MICROSTRUCTURE, FRICTION CHARACTERISTICS, AND WEAR. THE ION-BEAM PROCESSING OF SELF-LUBRICATING COATINGS, WILL BE USEFUL WITHIN GAS TURBINE ENGINES. ADDITIONAL APPLICATIONS INCLUDE THE AUTOMOTIVE AND CUTTING TOOLS INDUSTRIES.

WELDING ENGINEERS INC

5 SENTRY PKWY E - STE 101

BLUE BELL, PA 19422

CONTRACT NUMBER:

BRUCE SMITH

TITLE:

ENERGETIC MATERIALS CONTINUOUS PROCESSING USING A NON-INTERMESHIN COUNTER-ROTATING TWIN SCREW EXTRUDER

TOPIC# 6 OFFICE: IDENT#: 38839

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SAFER PROCESSING EQUIPMENT FOR PREPARATIONAL ENERGETIC MATERIALS IS BEING INVESTIGATED. HIGHER PRODUCT QUALITY IS EXPECTED THROUGH THE USE OF A BETTER CONTINUOUS MIXER: THE NON-INTERMESHING, COUNTER-ROTATING TWIN SCREW EXTRUDER. PARAMETERS ARE BEING IDENTIFIED WHICH ARE EXPECTED TO DEMONSTRATED THAT THE GEOMETRY OF THE COUNTER-ROTATING TWIN SCREW EXTRUDER HAS AN INHERENTLY PREFERRED MIXING PERFORMANCE FOR MIXING OF ENERGETIC MATERIALS. WHEN SUCCESSFUL, ANTICIPATED APPLICATIONS ARE: SUPERIOR PRODUCT CONSISTENCY AS A FUNCTION OF EFFICIENT MIXING; AND REDUCED SAFETY RISKS THROUGH LOWER PROCESSING AND LOWER SHEAR RATES.

WILSON GREATBATCH LTD

10000 WEHRLE DR

CLARENCE, NY 14031

CONTRACT NUMBER:

STEVEN J EBEL

TITLE:

SUPER HIGH ENERGY DENSITY BATTERY OF THE LITHIUM/BROMINE-FLUORATE ELECTROCHEMICAL SYSTEM

TOPIC# 5

OFFICE:

IDENT#: 38841

CURRENT STATE-OF-THE-ART PRIMARY BATTERY TECHNOLOGY HAS ACHIEVED ENERGY DENSITIES AS HIGH AS 1 Wh/cc, OR 500 Wh/kg. APPLICATIONS IN SPACE WILL REQUIRE EVEN HIGHER ENERGY DENSITIES, AND NOVEL BATTERY CONCEPTS ARE ONE APPROACH TO IMPROVING THE VOLUMETRIC AND GRAVIMETRIC ENERGY EFFICIENCY OF SPACE POWER. THE LITHIUM BROMINE FLUORINE (Li/BrF₃) COUPLE IS BEING INVESTIGATED AS A POSSIBLE NEW HIGH ENERGY DENSITY SYSTEM. THIS SYSTEM HAS PREVIOUSLY DEMONSTRATED AS (EMF) OF 5.12 V. IN ADDITION, BrF₃ HAS SEVERAL DESIRABLE PHYSICAL PROPERTIES. IF FEASIBILITY IS PROVED OF PACKAGING THIS SYSTEM IN CONFIGURATIONS SIMILAR TO CURRENT LITHIUM/OXYHALIDE CELLS, ENERGY DENSITIES AS HIGH AS 2.8 Wh/cc, OR 1500 Wh/kg COULD BE CONCEIVABLE ACHIEVED. IN DETERMINING THE FEASIBILITY OF DEVELOPING A Li/BrF₃ PRODUCT, THE EXPERIMENTATION IS FOCUSING ON MATERIALS COMPATABILITY AND GATHERING INFORMATION AS TO THE REALISTIC ENERGY DENSITIES IN PRACTICAL PRIMARY CELL PROTOTYPE CONFIGURATIONS. DRASTIC IMPROVEMENTS IN ENERGY DENSITY ARE DEEMED NECESSARY IN MILITARY SPACE APPLICATIONS. SUCCESSFUL DEVELOPMENT OF LiBrF₃

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SYSTEM INTO A USABLE PRODUCT COULD OFFER THE ORDER OF MAGNITUDE
ADVANCE IN POWER SOURCE TECHNOLOGY SOUGHT FOR SPACE APPLICATIONS.

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TOTAL NUMBER OF AWARDS: 155